The FOUNDRY

Volume 59
Number 8

Published
Semimonthly

CLEVELAND, OHIO, APRIL 15, 1931

Again THE FOUNDRY Invites You

INTEREST in the foundry world will center at Chicago on May 4 when the thirty-fifth annual convention and exhibition of the American Foundrymen's association opens at the Stevens hotel. To acquaint its readers with the plans for that important event, THE FOUNDRY in this issue presents complete information on the various activities which will be included on the program, including details of the technical sessions and shop courses, descriptions of the displays which will feature the exhibition of equipment and supplies, and interesting information on the foundries located in the convention city.

During the exhibition, THE FOUNDRY will maintain an exhibit in booths 210 and 212 in the grand ball room of the hotel. The space will be furnished as a lounge and visitors to the exhibition are cordially invited to meet their friends, to use all of the facilities offered and to rest amid the comfortable friendly surroundings after the strenuous rounds of inspecting the exhibits.

"So long—until we see you at Chicago."

THE FOUNDRY is published semimonthly by the Penton Publishing Co., Penton building, Cleveland, O. Member, Audit Bureau of Circulations, Associated Business Papers and National Publishers Association.

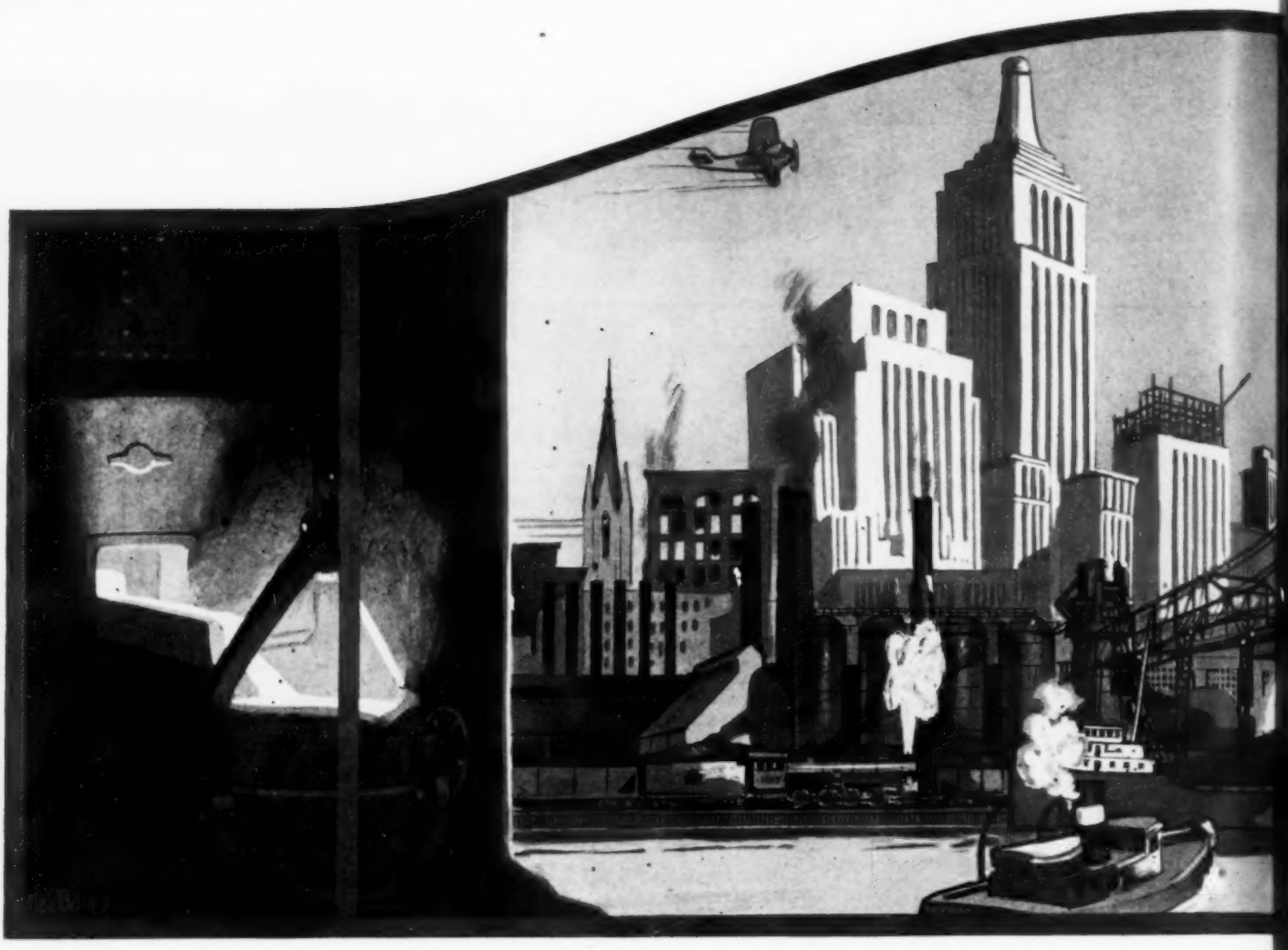
Branch Offices: Chicago, Peoples Gas building; New York, 220 Broadway; Pittsburgh, Oliver building; Cincinnati, Schmidt building; Washington, National Press building; San Francisco, Alto building; London, Caxton House, Westminster, S.W.1; Birmingham, England, 14 New street; Paris, 9 Rue de Londres; Berlin, Dahlmerstrasse 64A, Berlin Lichterfeld-West. Cable address, Irotrapen, London.

Subscription: United States and Mexico, $3.00 a year; Canada, $4 a year; Great Britain and other foreign countries, £1:0:0 a year; single copies 25 cents. Copies published three months or more previous to date of current issue, 50 cents each.

Copyright 1931 by the Penton Publishing Co.

CONTENTS

	Page
Mirroring an Industry	78
Prosperous Railroads Purchase Foundry Products Valued In Millions—By L. A. Downs	82
Wider Steel Market Advances Foundry Activity—By Charles M. Schwab	84
Oil Industry Uses Large Volume of Foundry Products—By W. C. Platt	85
Autos Use Thousands of Tons of Castings Annually—By Richard H. Scott	85
Buildings Acquire Beauty And Utility Through Castings—By Alfred E. Smith	87
Road Building Machinery Employs Large Casting Tonnage—By Charles M. Upham	88
Train Speed and Safety Place New Responsibility—By Fred W. Sargent	89
Shipbuilding Industry Closely Linked to the Foundry—A. H. Jansson	90
Use Steel Castings In Shipbuilding—By J. E. Burkhardt	91
Castings Aid in Giving Reliability to Naval Aircraft—By Hon. David S. Ingalls	92
Electric Railway Lines Require Diversity of Castings—By Guy C. Hecker	93
Foundry Products Take Drudgery from Agriculture—By Hon. Arthur Capper	94
Castings Are Important in Meat Packing Industry—By W. B. Allbright	95
Milling Industry Needs Large Volume of Castings—By James F. Bell	96
Castings Greatest Factor in Reducing Aircraft Weight—By J. H. Doolittle	97
Machine Tools and Castings Are Industrial Siamese Twins—By Ernest F. DuBrul	98
Transportation by Truck and Bus Speeds Nation's Goods—By George W. Smith Jr.	99
Municipal Improvement Needs Filled by Foundries—By C. W. S. Sammelman	100
Co-operation in Design Aids Heavy Machinery Industry—By G. W. Burrell	101
Pleasure Craft Utilize Many Castings in Construction—By S. J. Matthews	102
Heart of Automobile Displays Foundry Ingenuity—By E. L. Cord	103
Castings Are Essential To Production of Leather—By Fraser M. Moffat	104
Textile Industry Close Ally of Foundry Industry—By George B. Haven	105
Cites Casting Requirements For All Engineering Progress—By L. W. Wallace	106
Architects Take a New Interest in Use of Cast Metals—By Robert D. Kohn	107
Points to Castings Used in Heating and Ventilating—By Paul D. Close	108
Conditioned Air Occupies Important Role in Buildings—By R. V. Sawhill	109
A. F. A. Offers Valuable Technical Program	111
Representative Foundries in Chicago	114
Display Plan Provides Greater Facilities	117
Gray Iron Industry Realizes Metallurgical Advance—By Ralph S. MacPherran	123
The Foundry Family Photograph Album	125
The Foundry Data Sheet	126
Questions and Answers on Foundry Practice	127
Problems in Nonferrous Founding—By Charles Vickers	129
The Shakeout	130
Steel Founders Diagnose Sales Problems	131
Bill Tells Why Sand Falls From Cope—By Pat Dwyer	132
Comings and Goings of Foundrymen	135
What the Foundries Are Doing	136



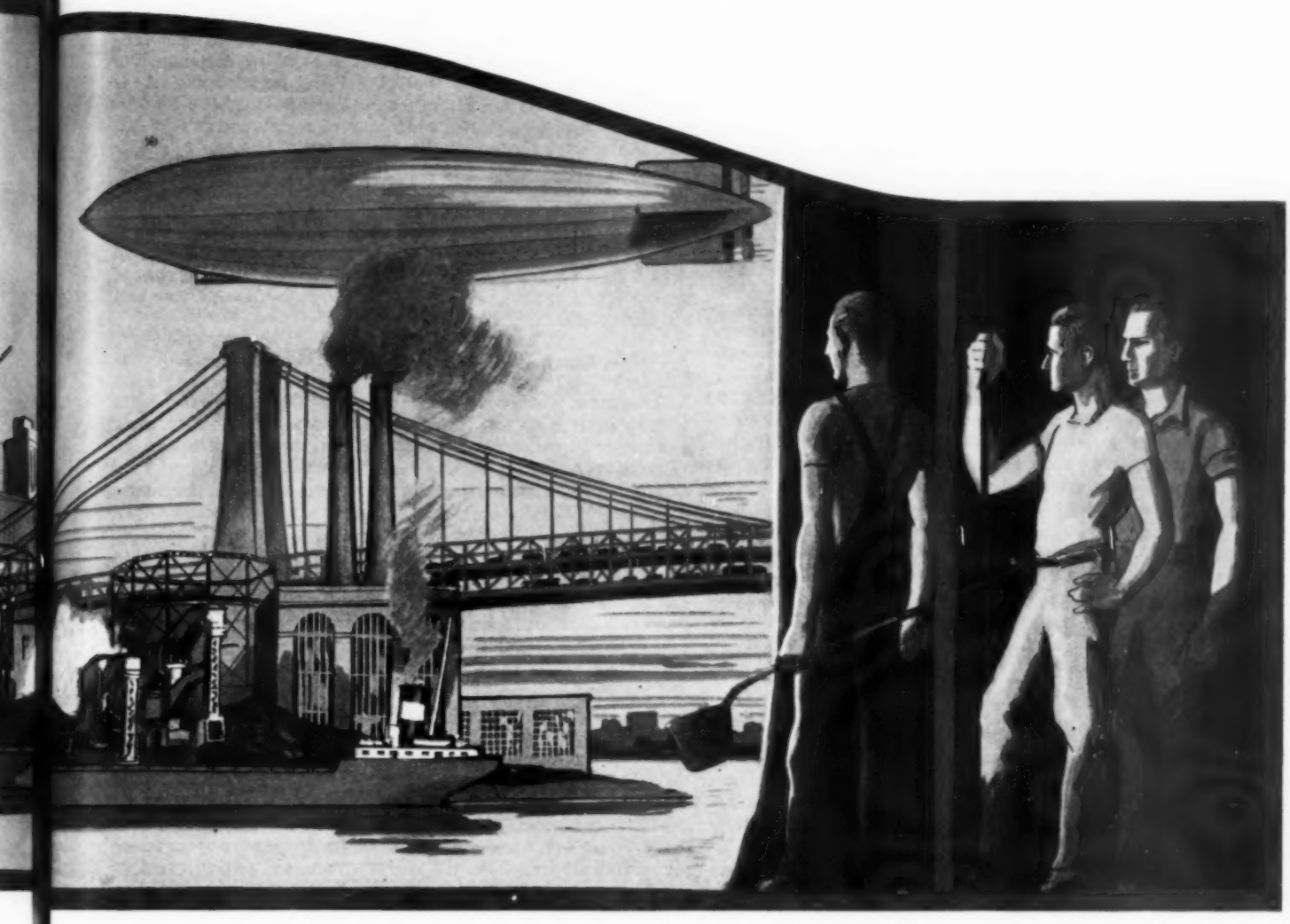
Mirroring

INTROSPECTION is a gift possessed by only a few talented individuals. The power of self examination is yet more rare among organizations of society. Industries that can look within themselves and appreciate the scope, order and importance of the service they render mankind are rare to the point of being unique.

Native self assurance that impells each person to affirm his worth and measure his accomplishments is powerless to portray even in a small way the sweeping picture presented by the industry of which he is a part. The farmer may assert in truth that his group feeds and clothes humanity. The manufacturer justly claims that without the conversion of raw materials to finished products, only primitive existence would remain. Each humble worker in the transportation field knows that without the service of *his* industry, commerce and trade would crumble and the commodities of both farmer and manufacturer would be unavailable. Each may be right. The dignity of such self assurance is entitled to all respect. Yet, the interdependence of each class, or group, or industry upon all others remains for outsiders to depict.

Foundrymen, as members of the broad class of industry covered under the term manufacturers, may express pride in accomplishment. The foundry industry in its far reaching ramifications finds few rivals in the scope and importance of the service it renders. Dating back to the first dim twilight of antiquity when men fought with ponderous beasts and with each other for bare existence, cast metals have served as weapons and utensils. Through medieval ages implements of war and peacetime utilities were devised of castings. Emerging to modern centuries, products of the foundry industry have made possible machines and structures of engineering skill.

Through all the history of mankind no other method of shaping metal to required form has been found to surpass casting. A blocky section here, a thin web there, a boss, a bracket, a recess, an irregular opening, a flat plane, a circular arc, a warped surface, fillets, angles, beads, letters, characters—whatever the variety of form, the dreamer may materialize his idea and the engineer produce his design in cast met-



An Industry

als. This is the reason for the basic character and the far reaching importance of castings and the foundation upon which the foundry industry is built.

To return to the statement which headed this article, introspection is rare. The viewpoint of outsiders often is essential to a true appreciation of values, no less in an industry than in an individual. Accordingly, THE FOUNDRY invited and has produced in the pages which follow, a cross section of opinion of men qualified to judge the interdependence of other industries and the foundry industry. The production of castings is so diversified and widespread that some who are not correctly informed even within the foundry industry, may have a lack of appreciation of the basic and essential character of cast products. These men, whose statements appear on following pages, speaking for the various lines in which they are dominant figures, hold the mirror up to the foundry industry.

Meanwhile, a brief resume of the influence of castings and the interdependence of the four fundamental divisions of modern industry, namely agriculture, manufacture, transportation and that general classification known as service, will serve to demonstrate the truth of these statements.

America has been transformed from an agricultural to an industrial nation in the past hundred years. At the beginning of the nineteenth century approximately 80 per cent of the male workers of the United States were employed on farms, and the consumption of products mainly was local. At present it is estimated that 25 per cent of the male workers of the nation are employed in producing enough food and other agricultural products for the United States, and furthermore a huge surplus for export to other countries.

The agricultural industry probably is one of the most striking illustrations of the influence of inventions in which castings form a vital element, upon the improvement of human welfare. From earliest history until the nineteenth century, agriculture primarily was performed by hand labor. Consequently, production was so limited that necessity compelled people to live on farms where by their own efforts they would

be assured of a proper supply of food, the life necessity.

Lack of food not only hampered the growth of cities, but also the growth of manufacturing, because farming communities, unable to produce a surplus of food for sale, naturally could not provide a market for the purchase of urban goods. However, in the early decades of the nineteenth century the development of labor saving devices for agriculture became an established fact, and today it may be said that the farmer is a machine operator. Therefore, he does not have to be a plow-wright, farm implement maker, harness maker, etc., but can devote his time strictly to farming.

Some conception of the great extent of agriculture may be obtained when it is realized that nearly 50 per cent of the land area of the United States is under cultivation. The reason for such an acreage is surmised when an acre of land yields 15.6 bushels of wheat, 34.7 bushels of oats, 28.2 bushels of corn, or 121 bushels of potatoes. In 1929 crops which were sold were valued at $5,461,000,000; animal products worth $6,856,000,000, and crops to the value of $4,617,000,000, fed to livestock were produced by the farmers of the United States. Invention of labor-saving agricultural implements relieved the farmer from considerable back-breaking hand labor, and in a little over a century was instrumental in changing the percentage of population of the country from 80 per cent engaged in farming to 25 per cent with a considerable increase in the amount of farm goods produced. Castings constitute and still form the basic element in the development of farm equipment.

Manufacture Depends on Foundry Industry

The birth of some forms of elemental manufacture in America probably antedated castings manufacture. However, from the first crude casting of firebacks and cooking utensils, the expansion of all classes of manufacture was closely dependent upon the advance of the foundry industry.

Manufacturing industries of the United States produced more in 1929 than in any similar period in the history of the country. Manufactured products during that year had a total value of $69,417,515,929, according to the department of commerce. That was a gain of more than seven billion dollars over the preceding year. Three industries produced in excess of three billion dollars worth of manufactured articles. Automobile manufacture was the leader with the meat packing and iron and steel industries following closely.

The combined foundry and machine shop industries stand fourth in the list with products valued at nearly three billion dollars. Oil refining and electrical machinery, equipment and accessories follow in the order named with products valued at over two billion dollars. Fifteen industries produced manufactured articles whose total value exceeded a billion dollars. Although the six industries named are but a small percentage of the 331 industries in the United States recognized by the department of commerce, bureau of census, they produce approximately 25 per cent of the total value of manufactured products. While the combined foundry and machine shop industries are rated fourth in value of products manufactured, the foundry industry, stands second to none in value to the industrial development of the country. Of the six industries named, it is impossible to name one that is not dependent fundamentally upon castings. The automobile industry, the leader, is well known as a large customer of the foundry. Without the castings used in the motor, transmission and differential assembly, it is doubtful if the automobile would have reached its present point of popularity. No other method of fabrication could produce a cylinder with such inherent engineering and design values as the foundry. Furthermore, machines utilizing castings play a part in every step of manufacture from crude ore, rubber, wood, glass, cloth, paint, and other materials to the finished automobile.

Castings Essential to Many Industries

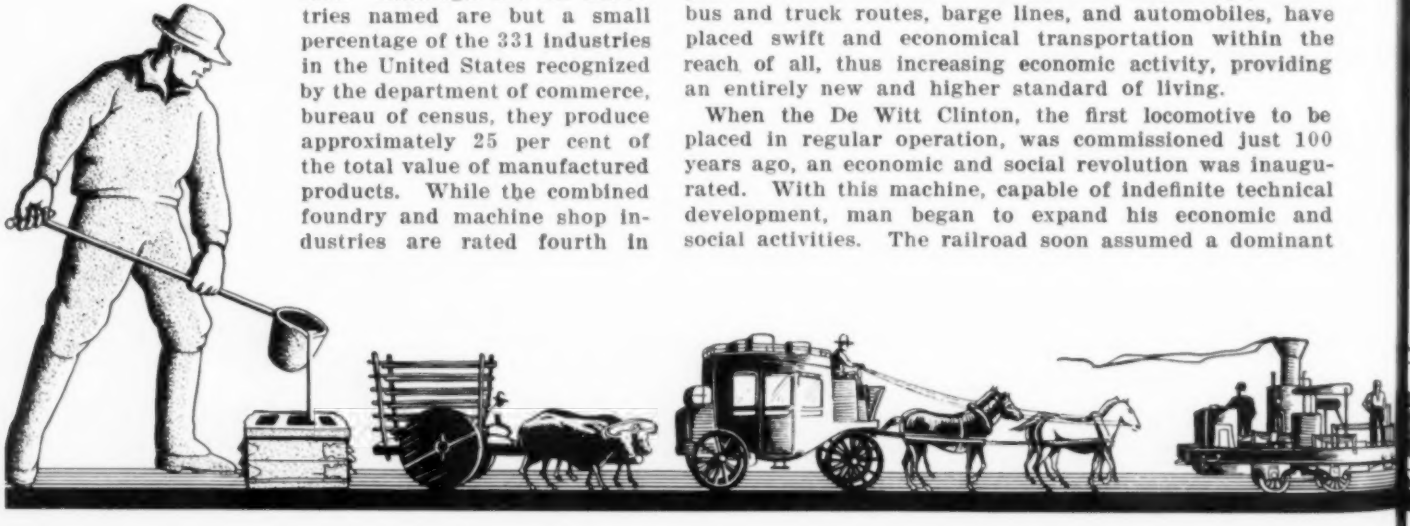
The iron and steel industry also is inter-related to a large extent with the foundry. Foundries contribute their products from the performance of the first operation, mining, to the last, finishing. Without the castings used in the mining, smelting and rolling of steel, the iron and steel industry as known today would be impossible. Disregarding all other contributions of the castings to steel manufacture, it would be difficult to visualize that industry in its present high state of development without the use of roll castings.

Thousands of tons of castings are used annually in meat packing. The use of castings in machine shop equipment is known so well that it requires no elaboration. Oil refining depends upon the foundry for many valves and fittings that withstand the high temperatures and pressures demanded in that industry. Motors, generators, meters, turbo-generators, water-wheel generators, insulator racks are but a few of the items in the electrical field in which castings are used.

The inter-relation of manufacturing and agriculture with transportation is so marked as to need no comment or elaboration. The transition from an agricultural to an industrial nation has been a factor of transportation agencies. The first locomotive made in America was the product of the West Point foundry in New York. The development and advance in motive power and rolling stock alike has been dependent upon invention and improvements in castings practice. It is a far cry from the first diminutive cylinders of the first old experimental locomotive "Old Ironsides," to the 60-foot steel casting that comprises the underframe for locomotive and tender and carries compound cylinders integral with the assembly.

Progress in transportation facilities has made possible today's highly complex social and economic system. Through the development and constant improvement of mechanical means for carrying passengers and freight on land, water and in the air, the field of commerce has become world wide and industry has found a market for the products of its factories. Railroads, steamships, motor bus and truck routes, barge lines, and automobiles, have placed swift and economical transportation within the reach of all, thus increasing economic activity, providing an entirely new and higher standard of living.

When the De Witt Clinton, the first locomotive to be placed in regular operation, was commissioned just 100 years ago, an economic and social revolution was inaugurated. With this machine, capable of indefinite technical development, man began to expand his economic and social activities. The railroad soon assumed a dominant



position in the nation's transportation system, and today, through mechanical improvements in rolling stock and motive power, splendid roadbeds, and a constant drive for greater efficiency and reduction of waste, the railroads stand first in the movement of persons and goods by land. In 1929, the steam railroads operated 249,432 miles of track and the electric railways added another 40,722 miles. The various roads operated a total of 2,323,980 freight cars, 53,838 passenger cars and 61,257 locomotives, realizing a total of $875,929,980 in passenger revenue and $4,899,167,876 for moving freight.

Play Important Part in Transportation

Of course, marine transportation, constitutes the backbone of international commerce. Ships plying the seven seas bring materials to the United States from practically every country of the world, to be processed further and then consumed by our own people or forwarded to foreign lands. Under the new policy recently adopted by the American government, substantial aid is being given toward the further rehabilitation of our merchant marine, which in 1930 consisted of 25,214 ships totaling 16,067,725 tons. Mechanical improvements constantly are revolutionizing water transport, and the application of the diesel engine is a recent marked advance.

The automobile, bus and truck are writing a new chapter in the history of transportation. Mechanical excellence in motor cars and millions of dollars invested in improved roads have combined to satisfy the passion for travel inherent in the American people. A year ago, 23,121,589 passenger automobiles were registered in the United States, and through federal or state agencies, 622,435 miles out of a total of 3,024,233 miles of roads had been provided with hard surface.

Originating first in the thickly populated sections along the eastern seaboard and then expanding rapidly, bus and truck lines now weave an intricate network through out the country. The application of the bus and truck to the services of the railroads is an exceedingly interesting development in this field. Some of the more important local and transcontinental bus lines are controlled by the railroads, in many instances supplying supplementary or feeder service. Railroads are using trucks to provide economical local service, to handle less than carload shipments in cities, to provide feeder service for localities previously lacking in transportation facilities, and to supply door to door delivery service. It is interesting to note that in 1929, 23,300 bus companies operated 92,400 buses over 784,485 miles of roadway.

Since the war, when the primary stimulus was administered to the aircraft industry, much attention has been accorded air transportation. Development of commercial flying has been accelerated largely through the intensive research of airplane manufacturers, operating companies and governmental agencies, including the army, navy and the post office department. On Oct. 15, 1930, the air mail was being operated over 32,011 miles, while the commercial routes covered 47,184 miles. In all services, commercial planes were scheduled to cover 123,771 miles daily.

The field of transportation provides one of the largest markets for the product of the foundry. Wherever mechanical transport is utilized, castings are important materials in the construction of the equipment. In fact, it is only through the extensive application of castings to the problems of the engineer that ships, railroads, automobiles, buses, trucks, airplanes, zeppelins and all other means of mechanical transportation are possible.

It is impossible to classify useful human endeavor on the basis of the fundamental industries covered by the terms agriculture, manufacture and transportation. A great broad field extends through all of these and ties them together along with all human existence. This field is known as the service industry.

In the field of service and under present conditions of existence, castings are as essential as the air we breathe or the food that sustains the body. Indeed, without castings, in some places the air would not be fit to breathe. In coal mines the ventilation is maintained by fans. The fans in turn are actuated by some form of prime mover, steam or electric, made up principally of castings.

Winning of ore and coal as cheaply as possible from its fastness in the earth is the problem of the mine operator, and in doing so he depends upon castings to aid him in his task. Statistics indicate that over 179,000,000 tons of iron, copper, lead and zinc ores, and nearly 541,000,000 tons of coal were mined in 1929. Many methods of mining are employed, but whether it be underground, open-pit, dredging or hydraulic, castings play a large part in recovering ores and coal. Drills, locomotives, cars, hoists, crushers, steam, gasoline or electrically operated shovels, compressed air machinery, and pumping machinery are a part of mining equipment in which castings are used.

Castings Used in Service Industries

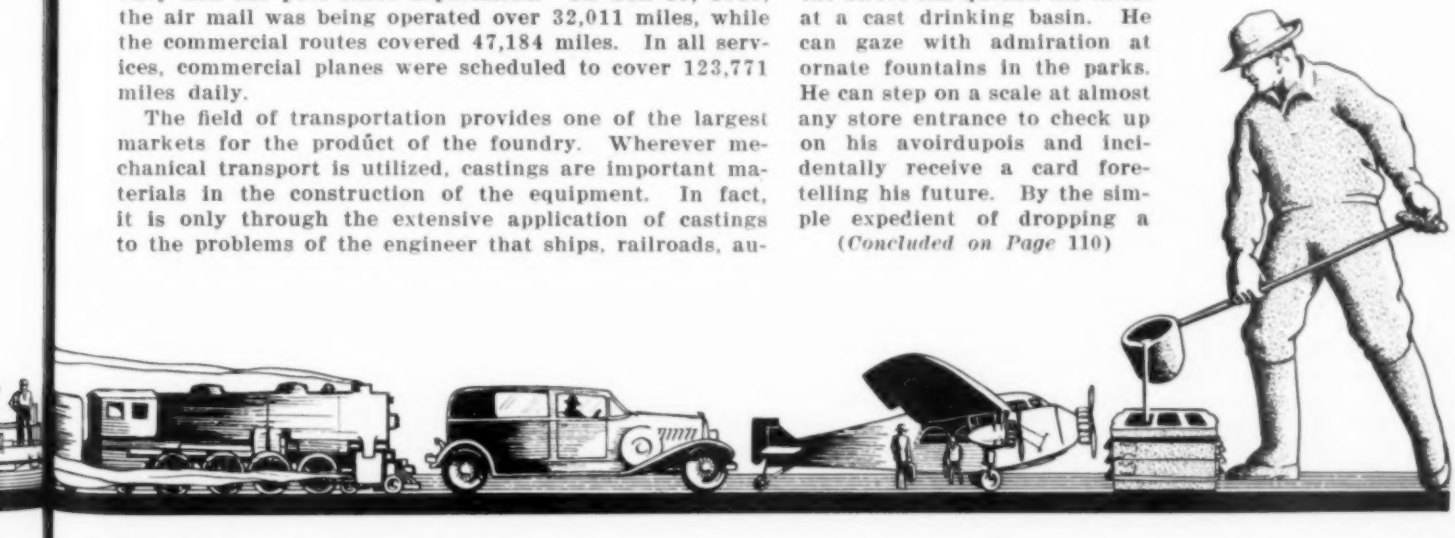
Castings enter extensively into the preparation of all kinds of food upon which civilized man exists. They are used in the cultivation of the ground, in planting the seed, in harvesting the crops, in storage and transportation, in the preparation of the containers, in the household utensils in which the food is cooked and served. Bakeries, packing houses, cold storage plants, prepared cereal factories, canning factories, bottling plants, are equipped throughout with castings.

Man's convenience, comfort, pleasure and efficiency only are possible through castings. Cast-iron pipes convey water under the streets of towns and cities to serve household needs, to afford fire protection, to sprinkle his lawns, to keep the surface of the streets clean and presentable and insure sanitary conditions. Average annual production of these castings in recent years in the United States has exceeded 1,500,000 tons.

Cast catch basins near the curb admit surface water to the sewers. Manholes in the streets afford access to tunnels containing telegraph and telephone cables and other cables conveying electric current for light, heat and power. Plain and ornamental standards support the lamps by which the streets are lighted by night. Castings support the stop and go signs by which police direct traffic.

The citizen strolling along the street can quench his thirst at a cast drinking basin. He can gaze with admiration at ornate fountains in the parks. He can step on a scale at almost any store entrance to check up on his avoirdupois and incidentally receive a card foretelling his future. By the simple expedient of dropping a

(*Concluded on Page* 110)



The Panama Limited, One of the Many Fine Trains Operated Between Chicago and New Orleans by the Illinois Central System

Prosperous Railroads Purchase Foundry Products Valued in the Millions

SOMEONE has compared modern business with the intricate mechanism of a watch, wherein every wheel either is driven by or helps to drive other wheels and every wheel is indispensable to the operation of the whole. Many instances could be cited to give point to this analogy, but few would be clearer or more effective than that of the interdependence which exists between the foundry industry and the railroads. These are essential and complementary parts of the nation's business mechanism.

Railway transportation enters into virtually every operation of the modern foundry. In the assembling of metals, fuel, sand and other materials used in foundry operations, the railroads perform a necessary service. Their part in the distribution of foundry products to widely scattered markets is likewise essential. Foundry patronage of the railroads is an important factor in maintaining railway earnings.

On the other hand, the foundries supply the railroads with a wide variety of products essential to railway operations. Foundry products enter into the construction and maintenance of locomotives, cars, tracks, bridges, shops and other parts of the railway structure, and railway purchases of foundry products bulk large.

In 1929 the Illinois Central System alone expended $1,719,000 for journal bearings and miscellaneous brass castings, $973,000 for cast iron car wheels, $645,000 for steel castings, $205,000 for gray iron castings, $175,000 for brake shoes, $58,000 for malleable iron castings and $17,600 for cast iron pipe, or a total of $3,793,000 for these seven groups of commodities. This is equivalent to 16.7 per cent of the system's purchases of all metal and miscellaneous products in 1929. If this percentage prevailed generally, the purchases of foundry products by the railroads of the United States as a whole in 1929 were in the neighborhood of $121,000,000.

These figures do not include the large quantities of foundry products which entered into locomotives, cars, machinery and other equipment purchased from manufacturers. On the other hand, it should be borne in mind that the figures are for a fairly prosperous year, when the railroads as a whole earned a return of 4.95 per cent on their property investment.

A striking illustration of the effect of poor railway earnings upon railway purchases is found in a comparison of the foregoing figures with those for 1930, one of the most unsatisfactory years in recent railway history, when earnings were reduced to 3.36 per cent and, in consequence, improvements, replacements and repairs were cut to the bone. Under these drastic curtailments the Illinois Central System's direct purchases of foundry products were reduced to $1,746,000, a figure 54 per cent under that of the previous year, while purchases of other metal products suffered likewise. If railway purchases for the country as a whole declined in the same ratio, instead of aggregate estimated purchases of $121,000,000 as in 1929, the 1930 railway purchases of foundry products would have been only $56,000,000, a loss to the foundry industry of $65,000,000 for the year.

These figures clearly illustrate not only the important stake which the foundry industry has in the railroads but also the necessity of keeping the railroads prosperous if the industry is to prosper. Prosperous railroads purchase foundry products in far greater quantities than

By L. A. Downs
President, Illinois Central System
Chicago

impoverished railroads do, and they also maintain service which benefits metal manufacturers by contributing to the efficient operation of their plants and the satisfactory marketing of their products.

In my opinion, the importance of safeguarding the railway market and preserving it in full vigor far overshadows any possible benefit which might come to the foundry industry through the further development of competitive forms of transportation.

We are living in an age when competition is as keen in the field of transportation as in the field of industry. It is unfortunate that the inherent advantages of the railroads over other forms of transportation are not so generally recognized as they ought to be. The railroads' adaptability to every form of transportation service, their assurance of permanence, their speed of movement, their punctuality, their reliability, their ability to operate everywhere and under all conditions should combine to give the railroads an economic advantage over other forms of transportation in handling the vast bulk of the nation's commerce. Their rates and fares, all items of cost considered, are no higher than those charged by others. Under fair and equitable conditions the railroads should have no difficulty in maintaining their position in the nation's industrial life.

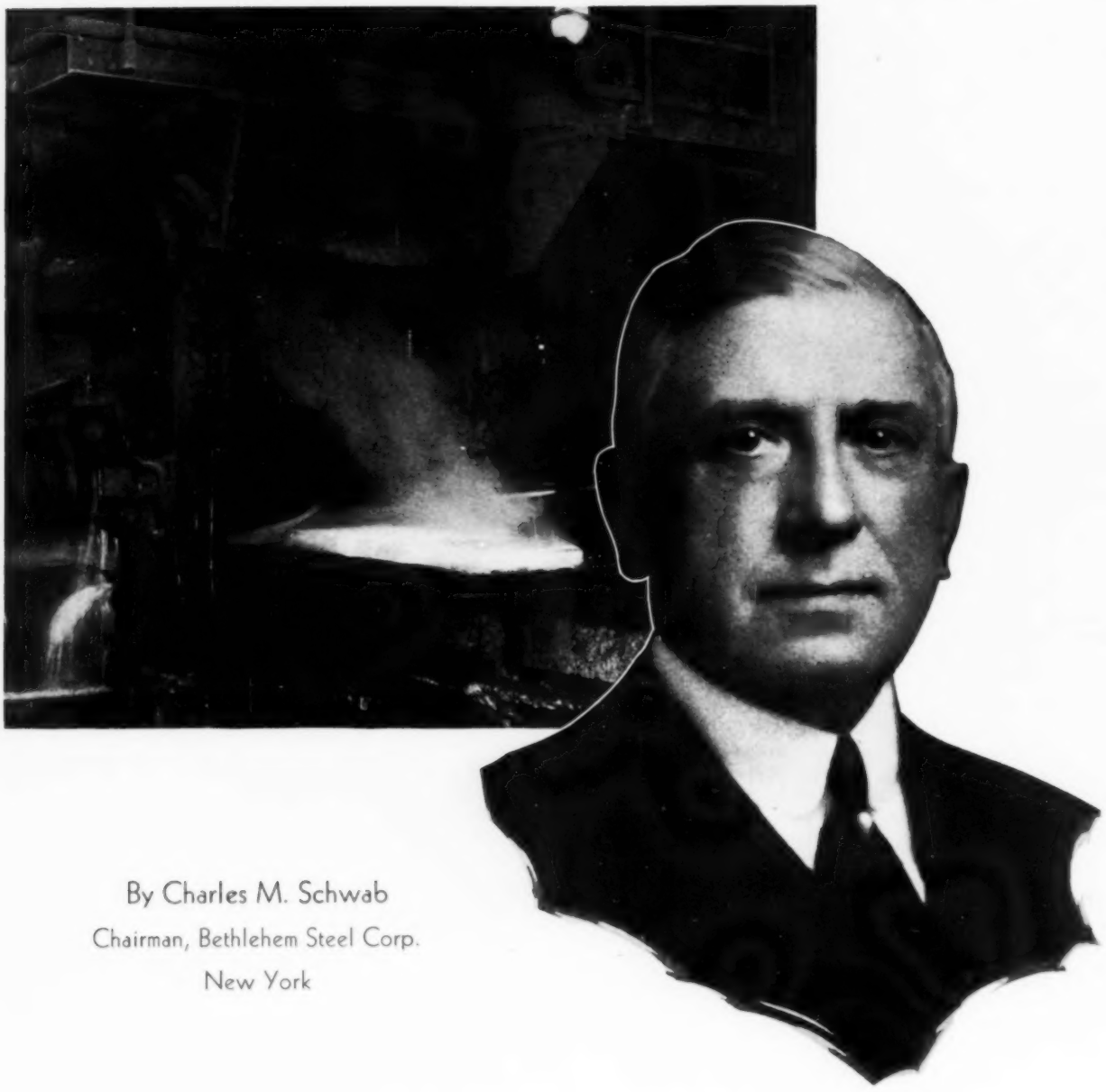
Unfortunately, however, the railroads are confronted with competition which is not fair. An enormous and rapidly growing fleet of motor trucks and motor buses is allowed to operate in common carrier service upon the highways built and maintained at public expense. These trucks and buses are hampered less than the railroads are by government regulations and roadway expenses, including taxation. They are under few restrictions as to wages, hours or schedules. They can discontinue service and disappear from the scene overnight if conditions are not favorable. Virtually their entire investment is on wheels which shift and drift with the tide of opportunity, irrespective of local needs and conditions.

The railroads, on the other hand, own and maintain their own highways. They pay heavy taxes upon these properties. They are extensively regulated as to the rates they shall charge, the wages they shall pay, the hours their employes shall work and the conditions under which they shall operate. They are required to expend large sums annually to comply with regulations and restrictions which local, state and federal governments have fastened upon them.

The federal barge service on the Mississippi and Warrior rivers is another example of the subsidized competition which is confronting the railroads. This government-owned and government-operated line is not only comparatively free of the usual restrictions or regulations; it does not have even the bus-and-truck requirement of paying taxes and earning a return on the value of its movable assets.

The railroads pay for taxes 6.3 cents out of every dollar received; for the maintenance of their roadway and other fixed property, 14 cents; for interest on borrowed capital and dividends to their owners, 16 cents. Here is a total expense of 36.3 cents on the dollar of receipts which the federal barge line escapes entirely and which the buses and trucks escape in very large part. Bus and truck rates vary in relation to railway rates, but seldom by amounts large enough to make up for the difference indicated above. The federal barge line transports freight on the Mississippi and Warrior rivers at 20 per cent less than competing railway rates, and many persons are being led to believe that this is all the difference to which the purchase of the service is entitled. As a matter of fact, when all hidden costs are taken into consideration, it should be clear that the railroads are providing the American people with much better transportation at lower cost than their competitors are.

Without subsidies or other unfair advantages, much of the railroads' competition could not survive. A square deal in transportation is the only way in which the interest of the public itself can be fairly served. A busy railroad is the public's best assurance of cheap, safe and efficient transportation and of employment, taxes and purchases in large volume. No part of the public should realize this fact more clearly than those who are engaged in the foundry industry.



By Charles M. Schwab
Chairman, Bethlehem Steel Corp.
New York

Wider Steel Market Advances Foundry Activity

IT MUST be clear to every serious observer of modern trends that the increase in the use of metal has been very considerable in the past few decades.

The popularity of skyscraper construction, the ever growing demands for transportation, and the advancement of machinery in all lines—all will continue to foster the use of iron and steel.

It is hardly necessary to point out that the advance of the metal industries includes the advance of foundry activities. You are doing an important work and I wish you continued success in it.

By W. C. Platt
Publisher, National Petroleum News
Cleveland

Oil Industry Uses Large Volume of Foundry Products

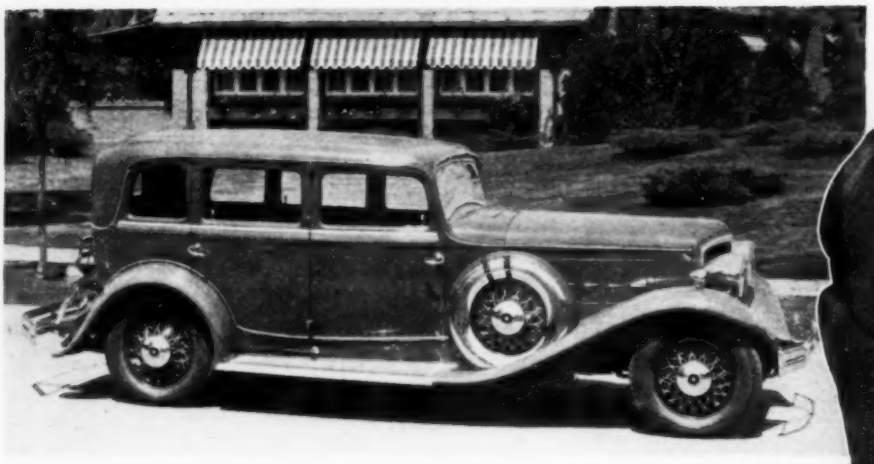
WHILE the oil industry has had its troubles, like other industries, those troubles are in a very fair way to be ironed out this year and some of them perhaps ironed out for good.

The chief trouble of the industry has been overproduction of crude oil in the fields and overproduction of the gasoline market at the refineries. With the cooperation of the governments of the important oil producing states, the industry is restricting production to market requirements by keeping the oil in the ground until it is needed, the safest and cheapest thing to do. Then by education and an intelligent use of statistics, and with the advice of the federal government, the refiners are holding back their output to what they can sell.

While much is heard about the "bad condition" of the oil industry, fundamentally it really is in better shape than for years because when it does start to improve, as it will shortly now, that improvement undoubtedly will be permanent.

The oil industry is a tremendous user of all kinds of metal, especially foundry products. A considerable quantity of our crude oil today is corrosive, and in the ordinary refinery operation we handle a lot of corrosive liquids. So all the way from the well almost to the consumer you find foundry products in fittings and valves and pipe, linings for pumps, grate bars and more than a score of other uses.

Due to the rapid development of the technique of oil refining and the ever changing character of our new crude oils, the oil industry is almost daily discarding old equipment for new, so in good days and bad, it is a steady customer of the equipment man. And 1931 will be no exception. In fact the need for lower costs and higher antiknock values of gasolines is crowding old methods and equipment out of plants more than ever.



By Richard H. Scott
President, Reo Motor Car Co.
Lansing, Mich.

Autos Use Thousands of Tons of Castings Annually

THE interdependence of modern industries, far from being lessened by the mergers which have become increasingly common, has become the very basis upon which all modern manufacturing operation is founded. The possibility of one manufacturer controlling and producing all of the materials which go into a modern motor car has been clearly demonstrated to be economically unsound and unprofitable. Such intricate mechanisms as the advanced cars of the day like the Reo-Royale require the products of nearly all of the countries of the world, both civilized and uncivilized.

The foundry is a factor whose importance cannot be under-estimated or neglected in any survey which might be made to determine the most vital parts of our modern motor cars. Unlike many of the things found on, and in, our present day cars, its use is not an outgrowth of recent discoveries but has been a vital factor since the birth of the automotive industry and has advanced along parallel lines of development.

The motor car industry serves, as well as depends upon, the foundry. Motor trucks are becoming increasingly valuable in the fast delivery of the foundries products to nearby markets where foundry to factory delivery at high rates of speed becomes a necessary part of sound and economical manufacturing procedure.

The importance of foundry products is clearly demonstrated when it is found that in the present Reo-Royale chassis there is 802 pounds of gray iron and 287 pounds of malleable iron. During the year 1930, the Reo Motor Car Co. bought 15,322,000 pounds of gray iron and 6,038,000 pounds of malleable iron.

The chrome nickel iron cylinder block, pioneered by Reo, is a foundry product which has meant much to the automotive industry. It was found through experimentation that additions of chromium and nickel of about 0.80 per cent nickel and 0.40 per cent chromium to plain cylinder iron gave a block which would machine readily, was free from chills and about seven times the life of the plain cylinder block with regard to wear of valve seats and cylinder bores. This block, as developed, not only resists pounding of the valves, but also does away with the burning of exhaust valves. Not only does this greatly lengthen the life of the motor car, but it increases the number of miles of trouble free operation and minimizes the adjustments necessary for wear.

[By Alfred E. Smith
President, Empire State Inc.
New York

Buildings Acquire Beauty And Utility Through Castings

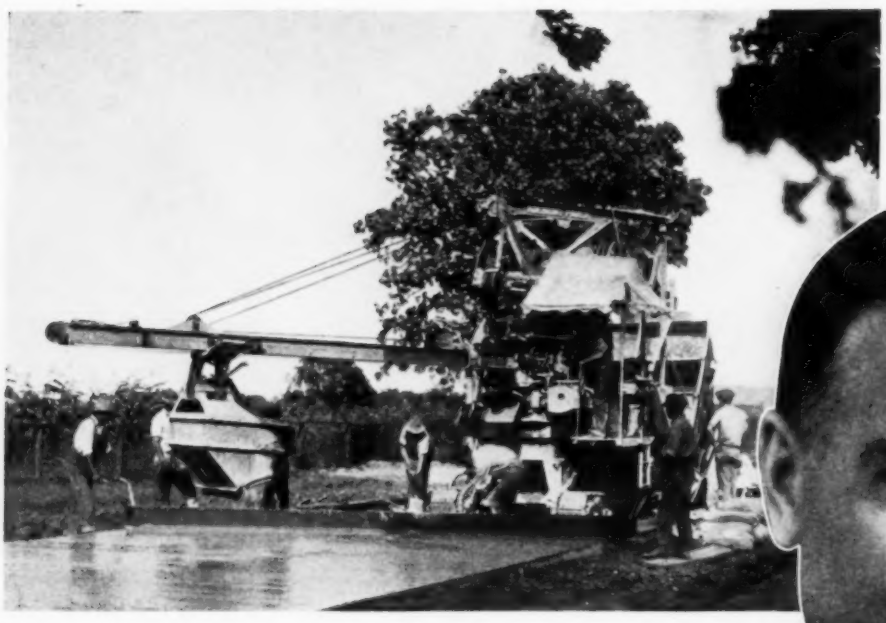
SO MUCH and important a building as Empire State is dependent for a whole phase of its construction on casting. An experienced examination of all the many uses of metal throughout the building would disclose that foundries played a most important part in new and unexpected ways as well as in routine materials for construction. Undoubtedly the manufacturers of castings and the men who make them are performing service which speeds up and simplifies the great building industry.

Foundrymen Contribute Products for Empire State

[EDITOR'S NOTE]

THE Empire State building which is nearing completion, is one of the most stupendous undertakings in the construction of commercial buildings. This is the highest building in the world, extending 85 stories above the street and with a total height of 1048 feet from the street level to the roof of the 85th floor. The observatory is above this level and a mooring mast for lighter than air craft extends 200 feet further giving a total height from the street level of 1248 feet, equiva-

(*Concluded on Page* 110)



By Charles M. Upham
Engineer-Director,
American Road Builders' Association
Washington

Road Building Machinery Employs Large Casting Tonnage

IN 1895 there were four automobiles registered in this country. In 1904 there were 55,000. Highways prior to this time consisted mainly of untreated gravel and macadam types which were adequate for the normal flow of horse-drawn traffic. At that time motor vehicle traffic became a factor and these existing highway types became impracticable.

Between the years 1904 and 1914 the greatest development of tar and asphalts for road surfacing took place. The first specifications for Portland cement concrete were compiled in 1909 but the first important construction of this type did not take place until 1912 when 250 miles of rural highways were built.

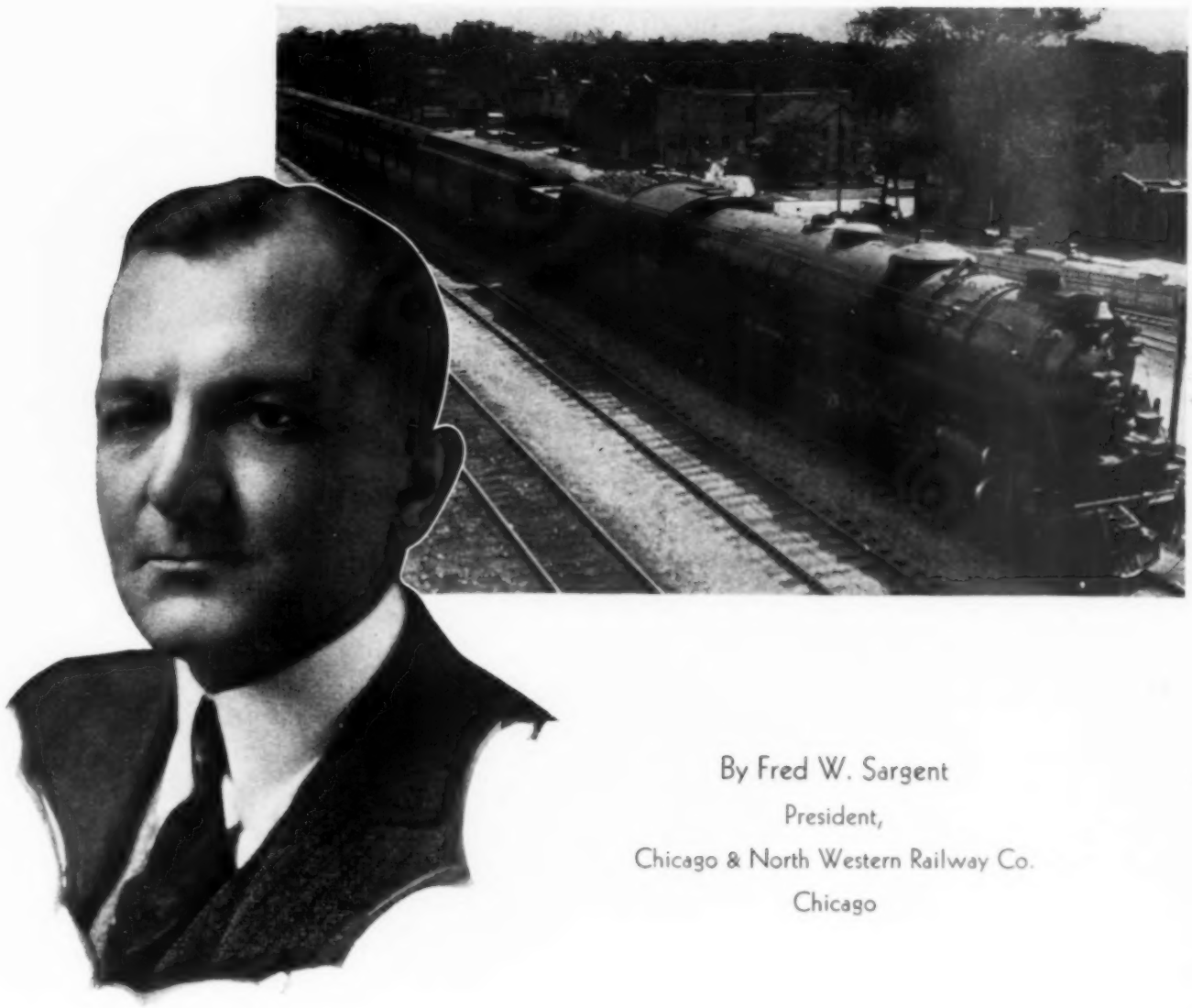
In ten years, 1904 to 1914 motor vehicle registration jumped from 55,000 to 1,700,000.

The total mileage of rural highways in 1904 was 2,151,000, of this there were only 144 miles of high type paving which consisted mostly of bituminous macadam of the penetration type. Total mileage increased to 3,016,000 miles in 1929 and high type surfacing to 112,000 miles. Total surfacing of all types increased from 153,000 miles in 1904 to 660,000 in 1929. Total automobile registration increased to 26,500,000 in 1929.

Obviously the rapid increase in motor vehicles over the past 15 years has continually forced the construction of more highways and has served as an impetus for improved design and mass production methods. This is proven by the fact that where a large mileage of highways have been built in a short period of time, automobile registrations have shown a rapid increase.

Among the factors which have led to the improvement in road building machinery during the past 10 years, perhaps the most outstanding is the demand for mass production occasioned by huge sums of money made available for the construction and maintenance of highways. These funds would have been almost useless had it been necessary to depend on horse drawn equipment, hand labor, and small construction and maintenance units. As an example of increasing production resulting from the evolution of machinery, prior to 1919 a two sack paving mixer could lay a maximum of about 400 feet of 18 foot portland cement concrete averaging 7 inches in thickness in a day. In 1919 a Michigan contractor laid 1000 feet of concrete 16 feet in width in 8 hours and established a record. A number of contracts in 1920 ran

(*Continued on Page* 109)



By Fred W. Sargent
President,
Chicago & North Western Railway Co.
Chicago

Train Speed and Safety Place New Responsibilities

THERE are few industries that do not in some way serve the railroads, and fewer that the railroads do not in some manner serve. It is doubtful if there is any line of endeavor that it as important to the prosperity and development of the country as the railroad industry. We have many problems that are not alone ours, but that must be solved jointly by those whose success depends to some extent on the prosperity of the railroads.

Recent development has made necessary steel cars of much greater capacity, requiring powerful locomotives to handle this increased tonnage, and as speed with safety is always an important factor, any delay to our trains due to failures of castings, is and always will be a serious matter.

It is not a difficult engineering problem to build more powerful engines, larger cars, or any kind of a steam plant if there are not restrictions on weight or size, but since it is not possible to change the existing roadbeds with their curves, switches, turntables, roundhouses, bridges, culverts, and other structures without prohibitive expense, the engineering minds went into a huddle and solved the problem of less weight with more strength.

The foundry engineer has taken a prominent part in developing castings of kind and quality not heretofore attempted, producing enormous castings which replace as many as 50 or 60 pieces of the earlier designs (tied together by hundreds or thousands of bolts and rivets) adding strength and safety, and reducing weight. Foundries have spent much time, energy and money in research work, and have achieved notable success in developing certain alloys which reduce weights materially and add strength and wearing quality, thereby increasing the factor of safety, and by no means the least important, reducing the cost of maintenance.

The foundryman is constantly on the alert and ever ready to meet new problems which modern railroad operation presents. For what he has accomplished, what he is doing, and what we have every reason to expect he will yet do, we give him due credit.

By A. H. Jansson
Editor, Marine Review
Cleveland

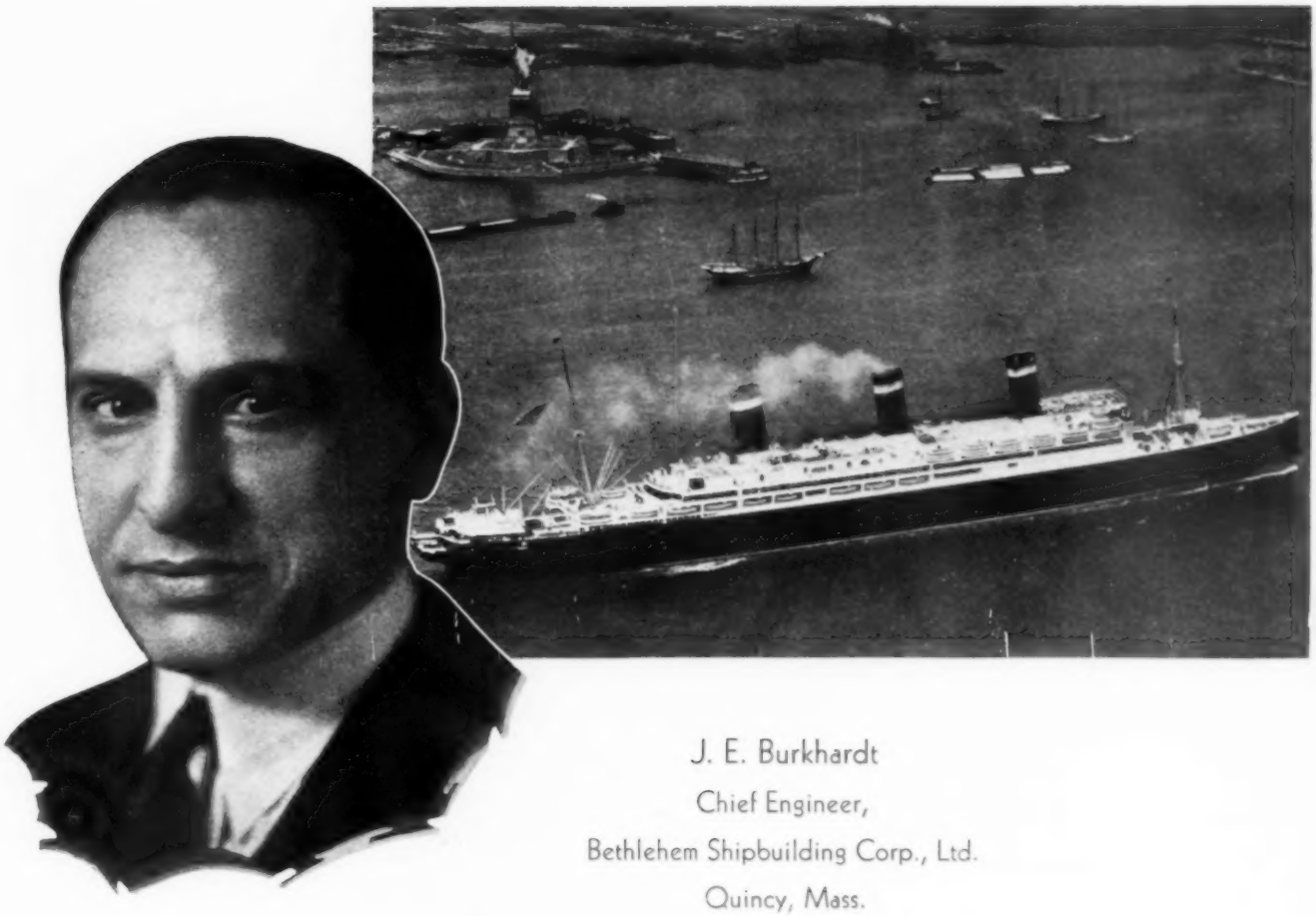
Shipbuilding Industry Closely Linked to the Foundry

PERHAPS no other structure of our highly specialized modern industrial civilization requires such a diversity of materials and so wide a range of skill in all the arts and sciences as a seagoing ship. It is therefore not surprising that the foundry industry is called on to furnish for the building of a ship, castings in practically all known metals and alloys in units weighing a hundred tons or more, down to fractions of a pound. These castings may be divided into two classes; those made to the order of the shipyard and fabricated by the shipyard; and those made by foundries, large and small, which go into the innumerable pieces of finished equipment and machinery needed for the completed ship.

One of the two 30,000-ton liners now building at the New York Shipbuilding Co., Camden, N. J., for instance will require several hundred wall fans and as much hardware, plumbing and lighting fixtures as a modern hotel. On the other hand, this ship is to be equipped with 1980 feet of cast steel anchor chain weighing a total of 111¼ tons and with links of 3 7/16 inches diameter stock, proof tested to 318½ tons. The anchors, of which there are at least five, all of steel castings, will vary in weight from 10 tons to 1½ tons.

Castings of steel, iron, bronze, brass, aluminum and other metals are used in large quantities on any ship and because of severe conditions of service the relative proportion of castings is greater than in any land structure. For the hull, steel castings are sometimes used at the stem and frequently used for the stern frame, including the propeller aperture and rudder post in single screw ships. In twin, triple and quadruple screw ships steel castings are used to carry the shafts where they emerge from the hull and for outboard strut bearings; also for stern frames of elaborate and complicated shape. Propellers may be made of cast iron, cast steel or manganese bronze. The latter material, often planed to a true helical surface and polished bright, is used in the better class and larger ships.

Every ship must have stern tubes holding the ingress of water around the propeller shafts. These are usually of cast iron. Tail shafts must be protected with cast bronze sleeves. Hawse pipes through which the anchor chain passes in and out are castings, either steel or iron. Chocks and bollards are usually of cast iron. Strongback slides on hatches and corner chafing pieces are sometimes castings. Numerous small castings are used as hangers for cargo battens and fairleads. Steel, brass and other metal castings are used for deadlights, portlights, window framing. Hardware is of heavy and often of special and orna-



J. E. Burkhardt
Chief Engineer,
Bethlehem Shipbuilding Corp., Ltd.
Quincy, Mass.

mental design in composition and sometimes in german silver and other alloys. Eyepads and numerous small deck fittings are sometimes of steel castings in place of forgings. Rail fittings are of malleable cast iron, steel and in some instances of bronze or brass. Goosenecks and boom rests are sometimes of steel castings.

Machinery on a ship may be roughly divided into three categories; main propelling machinery; engine room and fireroom auxiliaries; and above deck auxiliaries. Many castings of steel, iron and nonferrous metal represent much the major finished weight of all of this machinery. The propelling machinery is sometimes built by the shipyard in which case castings for cylinders, framing, bedplates, casings, bearings, condenser shells and many smaller parts must be cast either in the shipyard's own foundries or as is frequently the case purchased from outside foundries. When this is so the shipyard engineers are responsible for the design and specifications. Custom is changing rapidly in this respect. In the earlier day, and it carries through to the present time to some extent, the shipyard in its own machine shops would make to order and often of special design practically all of the machinery on board, including such auxiliaries as windlasses, steering engines and winches. Now with specialization the order of the day this is not so often done. Companies specializing in auxiliary machinery usually furnish this type of equipment. This is particularly so of deck machinery.

Several large companies now specialize in main propulsion machinery, including turbine electric, turbine geared and diesel engines. All of this machinery requires castings of elaborate design and rigid specifications. Other companies furnish pumps of all sizes and types, condensers, compressors, heaters, coolers, refrigerating machinery, blowers and fans, oil-burning equipment, coal burning equipment, valves and fittings, boilers and fittings, navigating apparatus and many other parts necessary for the well formed ship. All of these require the service of some skilled founder. Quality and uniformity in meeting and exceeding the high requirements for castings going into a ship place a premium upon a thorough knowledge and control of the processes of manufacture. A ship on the high seas might well be in great danger due to a defective casting in some vital point. I recall an instance of a freighter bound from New York for

(*Concluded on Page* 110)

Use Steel Castings In Shipbuilding

By J. E. Burkhardt

PRACTICALLY every kind of casting is worked into the construction of a ship—iron, steel, brass, bronze, aluminum and a variety of special alloys. In the structure of the ship there has been a tendency in the last 10 years to work in more steel castings in place of forgings and iron castings formerly used, and with the introduction to high pressures and high temperatures in the propulsion machinery of ships, steel castings have replaced iron, and special alloys have been substituted for brass and bronze. Where the saving of weight is important aluminum alloys are being used for small fittings that are not exposed to the weather.

By Hon. David S. Ingalls

Assistant Secretary of Navy for Aeronautics

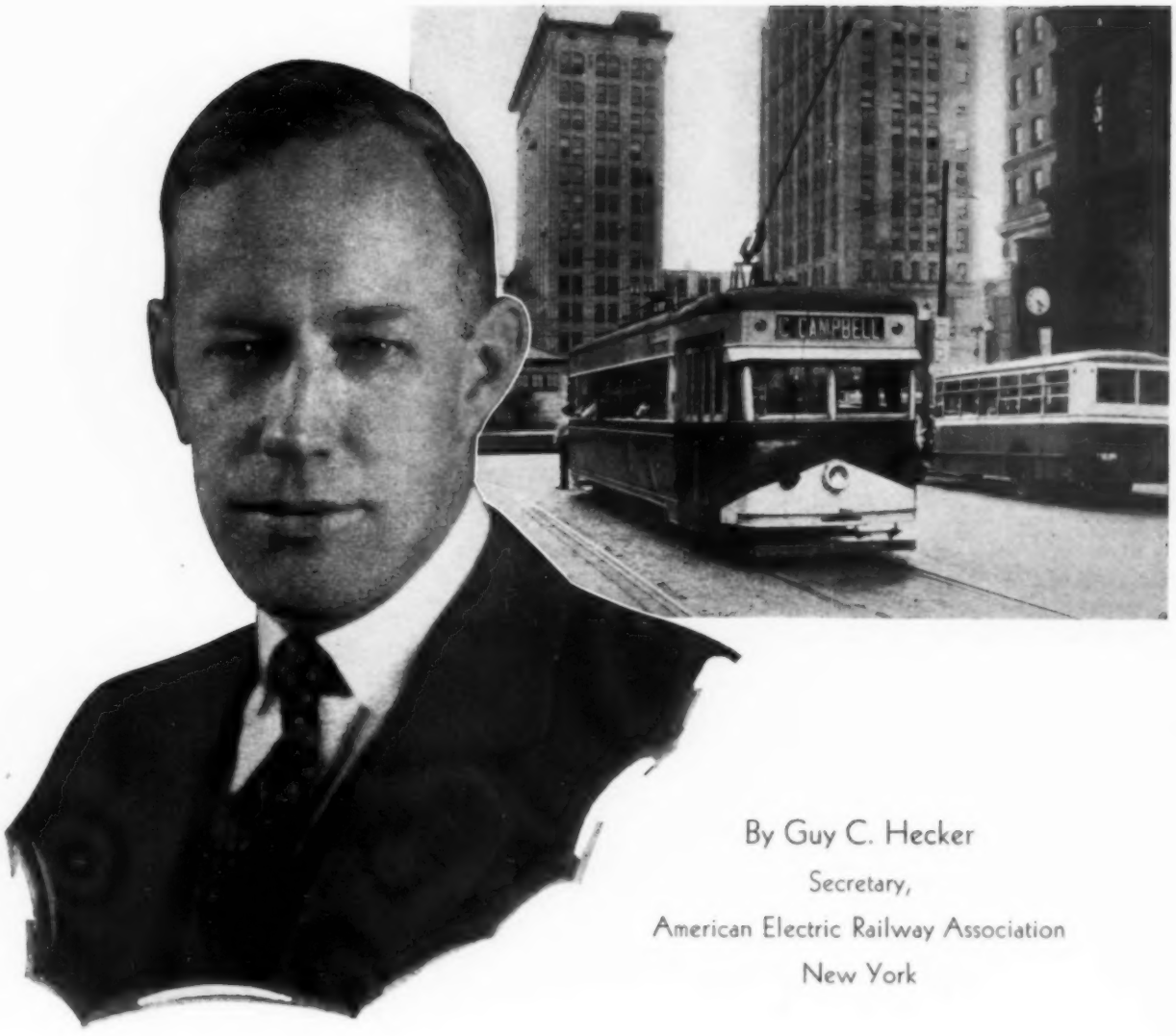
Washington

Castings Aid in Giving Reliability to Naval Aircraft

IT WAS my pleasure to witness the war maneuvers of the United States navy in Panamaian waters this winter. During these maneuvers the United States had in operation in southern waters 254 airplanes; in addition the Los Angeles was used as a scout. The United States navy recognizes the importance of the development of all types of heavier-than-air craft and also the importance of the development of lighter-than-air. As heavier-than-air and lighter-than-air are passing out of the experimental stage they are taking their recognized position as important arms of the fleet, both for offense and defense. Reliability both in the structure of the plane and of the dirigible is of paramount importance. In like manner, reliability in the engineering plants is mandatory. In this connection, castings of various materials form the important links in this reliability chain, and always keeping in mind that the chain is only as strong as the weakest link, each and every part must take its assigned load.

To attain perfect reliability with a minimum of weight is the goal for which all aeronautical engineers are striving. Therefore, the American Foundrymen's Association is assisting all of us who have our shoulders to the wheel of aviation development. In fact their shoulders are also endeavoring to push this wheel forward.

It is hoped that the convention will be a success and that by a mutual exchange of thoughts and information great progress will be made in improving castings throughout the United States, and it is my sincere wish that aviation castings will receive the full attention that their importance justifies.



By Guy C. Hecker
Secretary,
American Electric Railway Association
New York

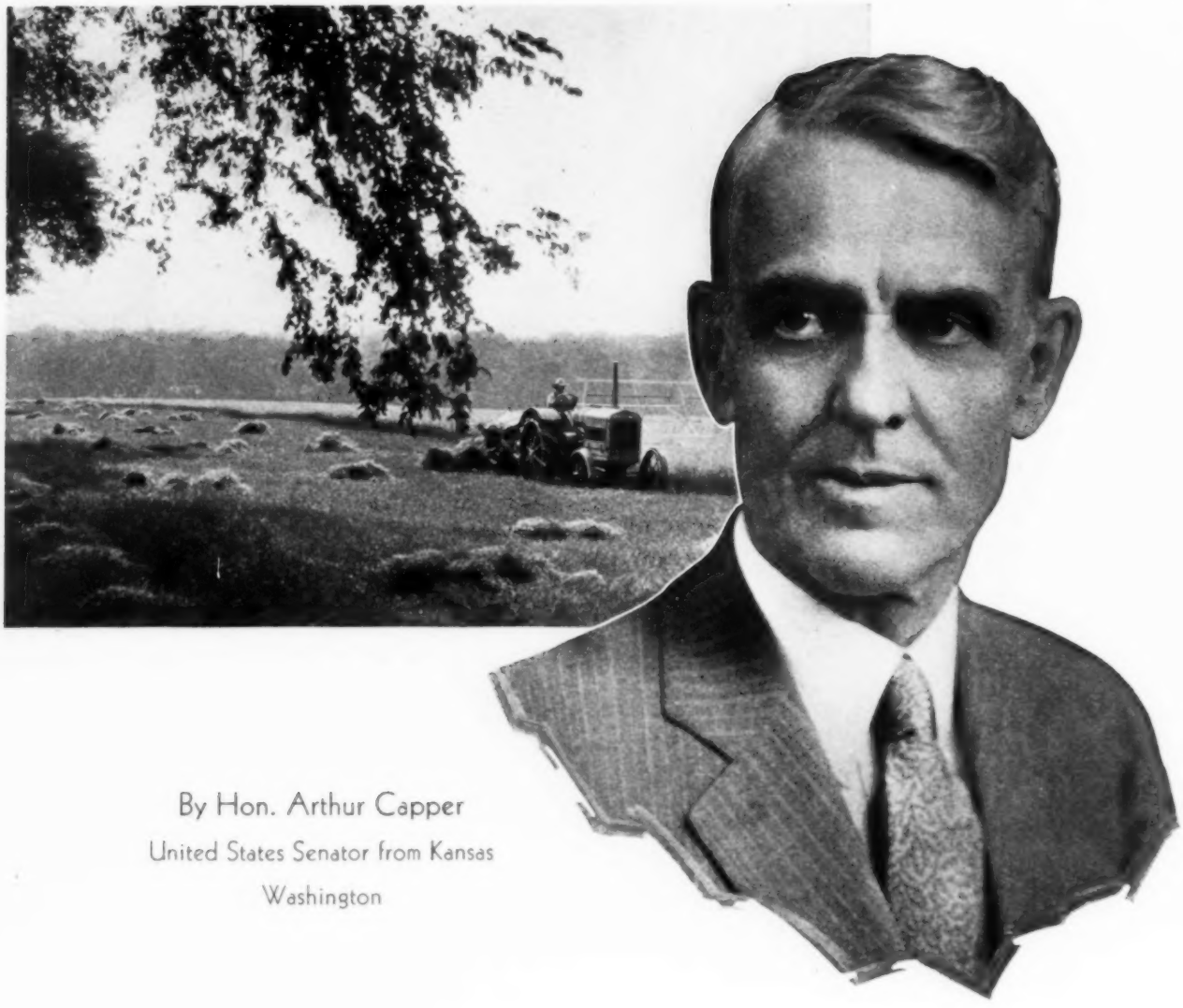
Electric Railway Lines Require Diversity of Castings

THE local transportation industry of the United States appreciates the great industrial value of foundries.

Electric railway managements purchase annually many thousands of dollars worth of foundry products. Many castings do not go directly from the foundries to the transportation company, but are routed through manufacturers of equipment, apparatus and supplies from whom the management purchase. These purchases include power plant and shop machinery, overhead line fittings, traction motors, trucks, special trackwork and other necessary supplies.

Thus foundries participate in a great national service. The local transportation business of the United States involves the moving of approximately 40,000,000 persons daily. In round numbers, some 65,000 miles of service is operated. This includes about 40,000 miles of rail line and 25,000 of bus service. The all too common opinion is that buses have supplanted a great deal of rail service. As a matter of fact, they have supplanted very little. Rather, they have added to the service which electric railway managements are offering.

In recent years the electric railway industry has been spending $1,000,000 daily, on an average, for new plant, equipment, and supplies. The foundries get a good share of this money. It is important that they keep their heads up and continue to do their job well.



By Hon. Arthur Capper
United States Senator from Kansas
Washington

Foundry Products Take Drudgery from Agriculture

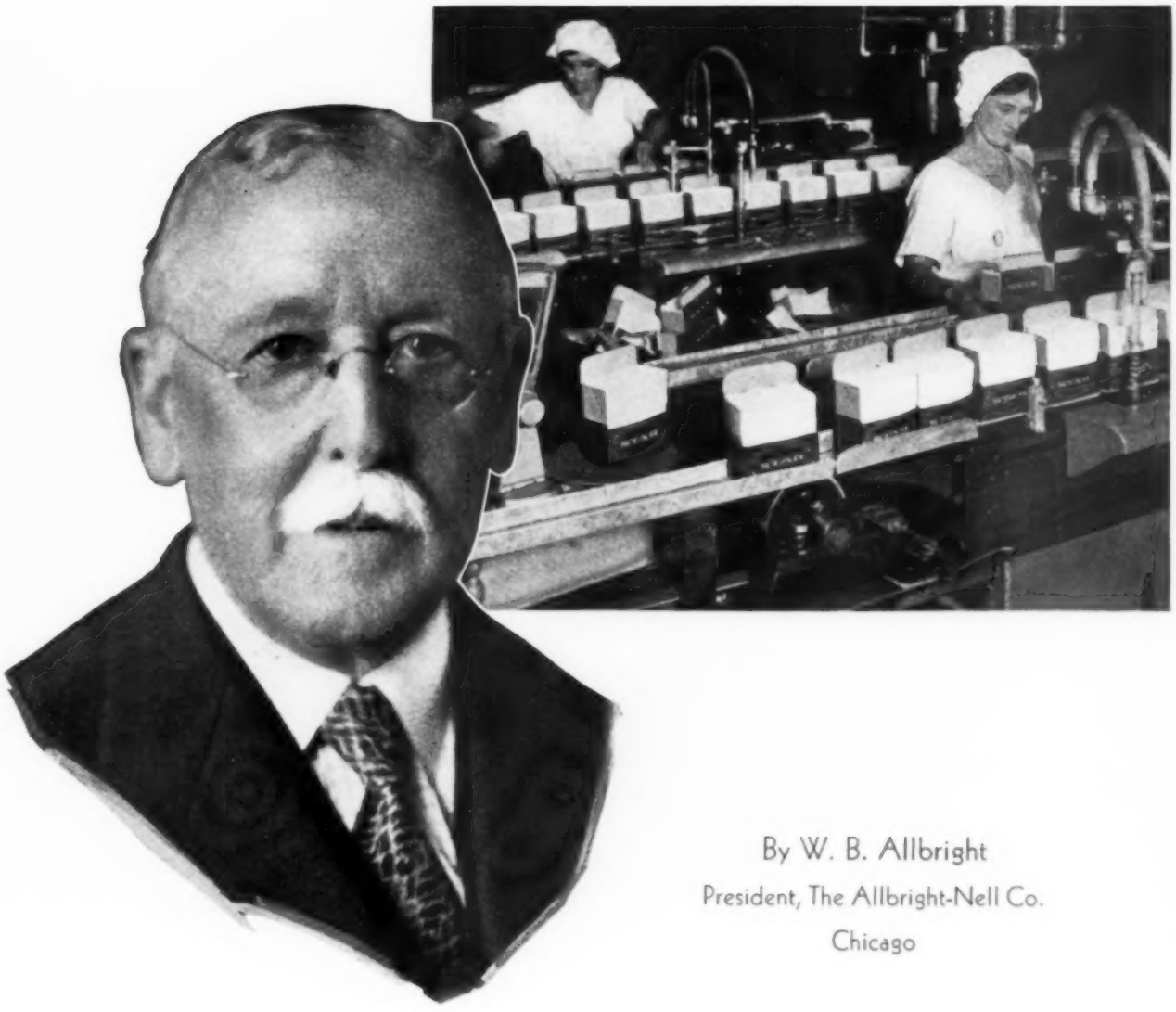
AMERICAN agriculture acknowledges a debt of gratitude to the American foundry industry, for this great industry, together with the other metal working industries of the nation, has lifted a great burden of drudgery from the American farm and the American farm home. To the foundry and the machine shop of the city has been transferred much of the back-breaking labor once needed to plant and harvest American crops.

American agriculture a hundred years ago was much the same as the agriculture of primitive times. A crudely wrought plow had replaced the forked stick of our forefathers; the cradle had replaced the sickle, but otherwise the tilling of the soil and the harvesting of the crops had not changed much from Biblical times. It took many hands to produce the food needed in those times. Four times as many people lived in the country as in the city.

Today agriculture has undergone a mechanical revolution. The number of horsepower at the command of the American farmer has been multiplied many times. This great change began a hundred years ago with the invention of the reaper by McCormick and was followed shortly afterwards by the perfection of the steel plow. From that time dates the mechanization of agriculture, which has liberated the American farmer and his family from the long hours of back-breaking toil that once characterized this fundamental industry.

From the foundry and the machine shop of the city with their modern facilities have come the great combines drawn by tractors and the many other time and labor-saving implements of modern agriculture. Likewise have come similar labor-saving devices for the farm home, water and lighting and heating systems which have brought all the comforts of the city to the farm home, at the same time preserving the qualities which have made the American farm home the reservoir of leadership and statemanship for our nation's business and government.

The American foundry industry has played its part well in this emancipation from drudgery on the farm and in the farm home. Mass production and fine engineering skill in American foundries has made it possible for one person in the country today to support four people in the city, the reverse of the ratio a century ago. I compliment you on keeping your business in the forefront of progress. Your progress makes for progress on American farms.



By W. B. Allbright
President, The Allbright-Nell Co.
Chicago

Castings Are Important In Meat Packing Industry

THE meat packing industry has grown in the past 50 years from the simple slaughtering establishment of those days, using very little machinery, to a very complex and highly specialized industry, using an enormous amount of machinery.

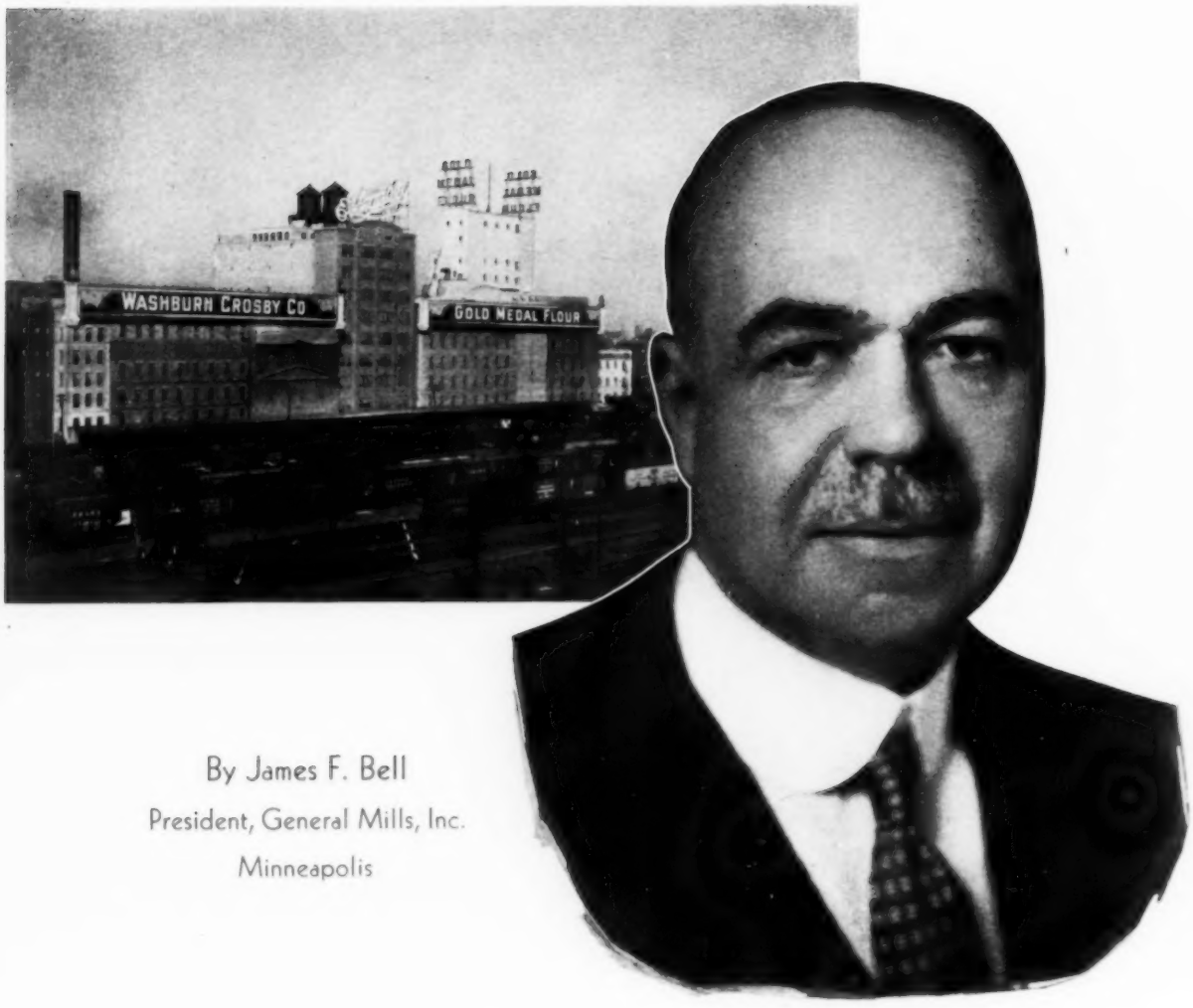
In this, castings play a very important role. It is difficult to determine what volume castings bear to the total of machinery used, but it is safe to say that there are hundreds of thousands of tons of castings in service in the meat packing industry.

Packing plants vary from enormous establishments, like Armour & Co. and Swift & Co., to firms supplying a very limited quantity of products to more local markets. However, castings form an important place in making more successful in operation machines that are being introduced for improvement in many of the various departments.

An iron foundry and castings are frequently spoken of in an indifferent sense, but really this industry has made remarkable improvements in the last 15 years, and today the high speed machines used in packing plants are very largely constructed of specialized castings in which a small percentage of alloys has been incorporated, making superior castings.

Castings are also taking the place of fabricated steel construction on account of the more rigid support that cast iron bases give to the machinery. Lard cooling rolls, originally made of cast iron, are now made of castings with special alloys, whereby greater efficiency is made possible due to the more rapid transmission of heat through these special castings.

The casting industry is keeping pace with other industries in making improvements in their products, and the use of specialized castings in the packing house industry is increasing, displacing a good deal of the old-fashioned angle iron and steel construction formerly used.



By James F. Bell
President, General Mills, Inc.
Minneapolis

Milling Industry Needs Large Volume of Castings

IT IS highly probable that some products from the first foundry found their way into flour mills. The flour milling industry is one of the very oldest, and in its successive stages of development through many centuries has availed itself of new mechanical products and processes as these have become available.

For the last 50 years flour milling has been a fully mechanized process, and as such flour mills have absorbed millions of tons of foundry products, from the smallest sprocket to fly wheels and engines weighing thousands of tons.

The relations between foundries and flour mills have, to a certain extent, been reciprocal in that during this same period foundries have and continue to use a considerable volume of low grade flours in their processes.

From an essentially localized operation, flour milling has developed through various stages until today the big milling companies are world-wide in their operations. Less than 50 years ago there were more than 20,000 individual flour mills in the United States, whereas today, in this vastly larger country, 1000 mills perform practically all the commercial milling, including the millions of barrels of flour milled for export to all parts of the world.

As an example of this trend, General Mills, Inc., which was formed in June, 1928, today operates 23 flour, feed and cereal milling plants, situated in 14 states from New York to California and from Minnesota to Texas. These plants have a total daily capacity of 85,850 barrels of flour, 5675 tons of commercial feeds and 465,000 pounds of cereals, and are served by terminal elevators with a total capacity of 36,292,000 bushels of wheat and country elevators with a capacity of 11,759,000 bushels of wheat. The products of these mills, particularly the Gold Medal brand of flour, are sold in every state in the union and in 90 different foreign countries.

As flour has been the basis of civilized man's diet for so many centuries, it is reasonable to assume that the flour milling industry will continue to absorb vast quantities of foundry products for a great many years to come and the business relationships which have been built through development of these two industries will continue on a large scale.

By J. H. Doolittle
Manager, Aviation Department,
Shell Petroleum Corp.
St. Louis

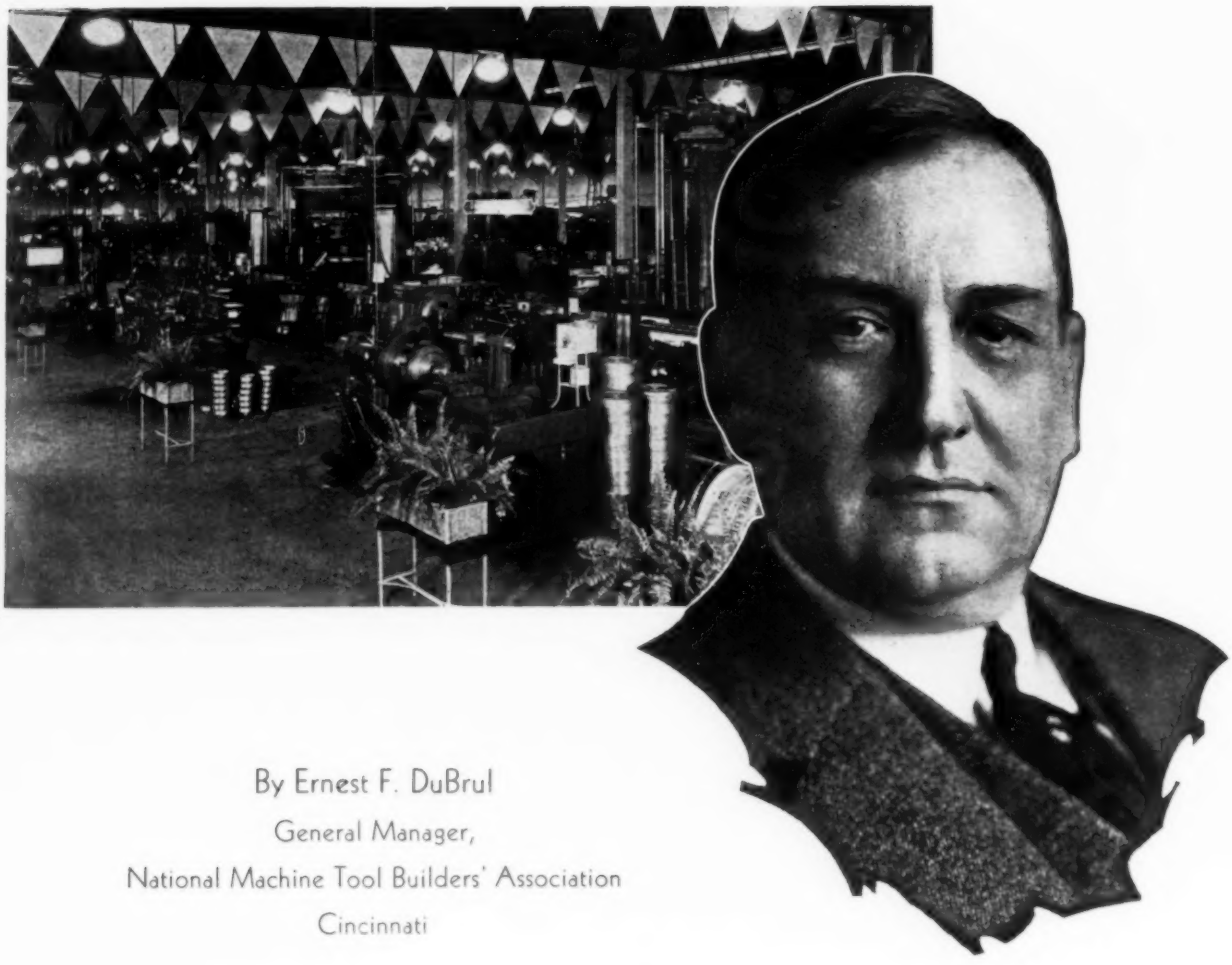
Castings Greatest Factor in Reducing Aircraft Weight

THE greatest single item in reducing the weight per horse power and increasing the reliability of aircraft engines is the development, to its present high standard, of light alloy casting.

EDITOR'S NOTE: The career of J. H. Doolittle in military and commercial aviation is one of the most notable in the annals of that great industry. Through his exploits as covered in the daily press, he is known familiarly to hundreds of thousands as Jimmie Doolittle. Five years ago in Santiago, Chile, his name became an international byword as a result of his flying skill in the control of an army plane that he had gone there to demonstrate. He was on the balcony of a house a few days before the demonstration when it fell and he broke both his legs. Contrary to surgeons' orders he proceeded with the flight though both his legs were in plaster casts. In the demonstration one of the casts was broken and surgeons refused to mend it unless he agreed to abandon further flight tests. This he refused to do, though a medical attendent exclaimed, "You are a flying Yankee hellion. It is suicide to fly in your condition."

Crowds at the air races in Cleveland in the fall of 1929 were given a thrill not on the bill of fare when a Curtiss-Hawk army pursuit plane piloted by Lieut. Doolittle lost its wings during a dive with wide-open throttle. He took to his parachute at 3000 feet. In September of the same year at Mitchell field, L. I., he tested scientific instruments for blind flying. In the course of these tests he was the first man to take off, fly, and land without vision in a covered cockpit.

Though spectacular in execution, these achievements of Mr. Doolittle have their basis in careful training and study. He left the University of California, and took training at Rockwell field where he was commissioned in 1918. He graduated in mechanics school at Kelly field, Aug. 1, 1919, and from engineering school at McCook field, June 22, 1922. He was connected with Massachusetts Institute of Technology during the period 1923-1925. At Baltimore in 1925 he won the Schneider cup race, and with Lieut. Cyrus Bettis, was awarded the Mackay trophy for 1925. The Harmon trophy for 1929 was awarded to him on April 7 of this year in recognition of his blind flying experiments.



By Ernest F. DuBrul
General Manager,
National Machine Tool Builders' Association
Cincinnati

Machine Tools and Castings Are Industrial Siamese Twins

IT WOULD be difficult to find two industries that are more closely related than the foundry and machine tool industries. The more castings the country requires, the more machine tools are needed to fabricate the castings into the finished form. So too, as castings constitute the bulk of the material used in manufacturing machine tools, the more tools that the country needs, the more castings the machine tool industry needs to build them.

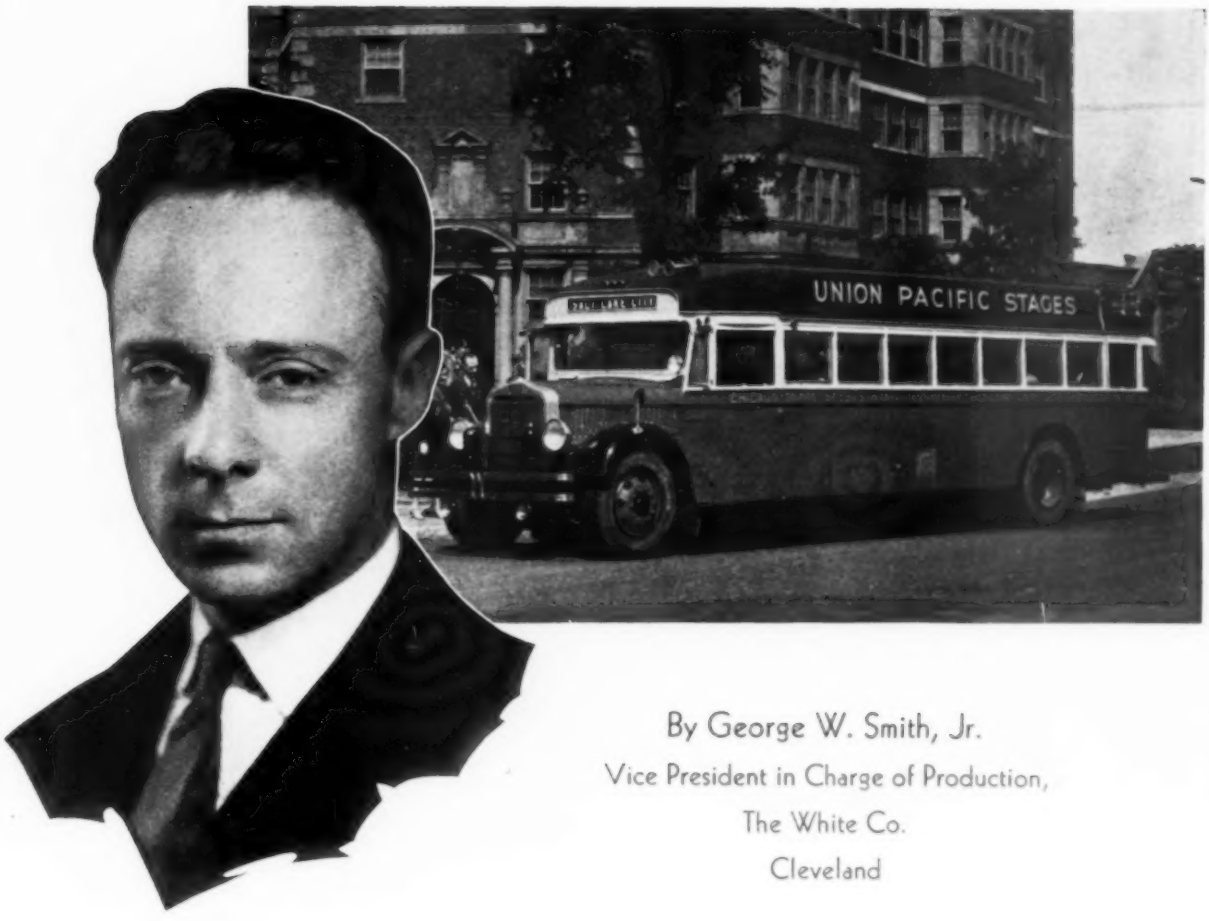
As users of castings, the machine tool industry is an important customer of the foundry industry in the states north of the Ohio and Potomac rivers and east of the Mississippi. According to the reports of the United States census of manufacturers, the machine tool group is second in size of the many which go to make up the large class of 10,000 producers of industrial machinery, the largest group of these being the makers of textile machinery. The machine tool group numbered 272 establishments in the census of 1929. In that year of boom, the total value of machine tool production reported by the census was $172,349,996.00. So the castings used to produce these machine tools was an important item of foundry product.

The best quality of the castings is needed in machine tools. One need only consider the service that machine tools are put to in machining hard and tough steel under heavy cuts, to realize that the machine tool industry requires the best castings that can be made.

Every advance in the art of cutting metal means larger and better machine tools. As the machine tool industry has developed its machines from the small, light, simple mechanisms of years gone by to the large, heavy, complex constructions of the present day, the foundry industry has kept pace with the machine tool industry's need for better and better castings.

The two industries are not only closely related in this mutual business between themselves, but they are also closely related in supplying other users of castings, who necessarily finish them on machine tools.

To illustrate how the two industries must be kept in pace, we need only consider that when a new cutting material evolves, permitting the fast machining of harder material, the machine tool industry is called on for machines that will do this fast cutting. At the same time the foundry industry is called on to produce harder and stronger castings. Both these industries have always answered these calls. As a result society as a whole has continuously received better and better metal products of all kinds, as well as more products per unit of production effort.



By George W. Smith, Jr.
Vice President in Charge of Production,
The White Co.
Cleveland

Transportation by Truck and Bus Speeds Nation's Goods

WITHIN the short space of ten years bus and truck transportation has grown from an infant stage to become an integral part of our economic structure.

Everything we wear, everything we eat, the lumber for our houses, in fact everything needed for our daily life at some time or other is carried on trucks.

The growth of truck and bus transportation is readily seen in the annual roll call of the White company which lists the names of 1483 truck and bus operators who are operating 50,481 vehicles in fleets of ten or more, representing an investment of over $175,000,000.

In White trucks and busses castings are vital, being used in engine blocks, engine heads, manifolds, crankcases, pistons, brake drums, spring brackets on frame, front wheel hubs, rear axle housings, etc.

Castings will continue to be essential and vital in the manufacture of trucks and busses.

By C. W. S. Sammelman

Secretary,

American Society of Municipal Engineers

St. Louis

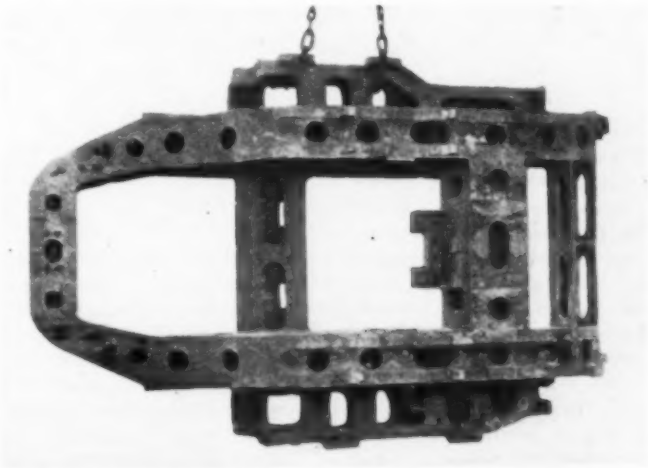
Municipal Improvement Needs Filled by Foundries

TO KNOW something does not always mean that one fully realizes it. Castings are in such general use that many of us fail to realize the extent or the importance of the industry manufacturing them. Occasionally a photograph of an unusually large casting is found in the rotogravure section of our Sunday newspapers without any mention being made of its millions of little cousins. To realize the tremendous importance of the foundry industry, one has but to attempt to visualize the millions of castings used daily in almost any common place undertaking. This is particularly true in the municipal field where there is a greater demand for them daily. The development of the United States into an industrial nation rather than one of agriculture means the growth of our urban population as is borne out by census statistics. To care for these millions of people moving to the cities, extensive improvements must be made which insure a continued demand for products of the foundry too numerous to mention here. This industrial growth of the nation should bespeak for foundries the continued increased need of its products.

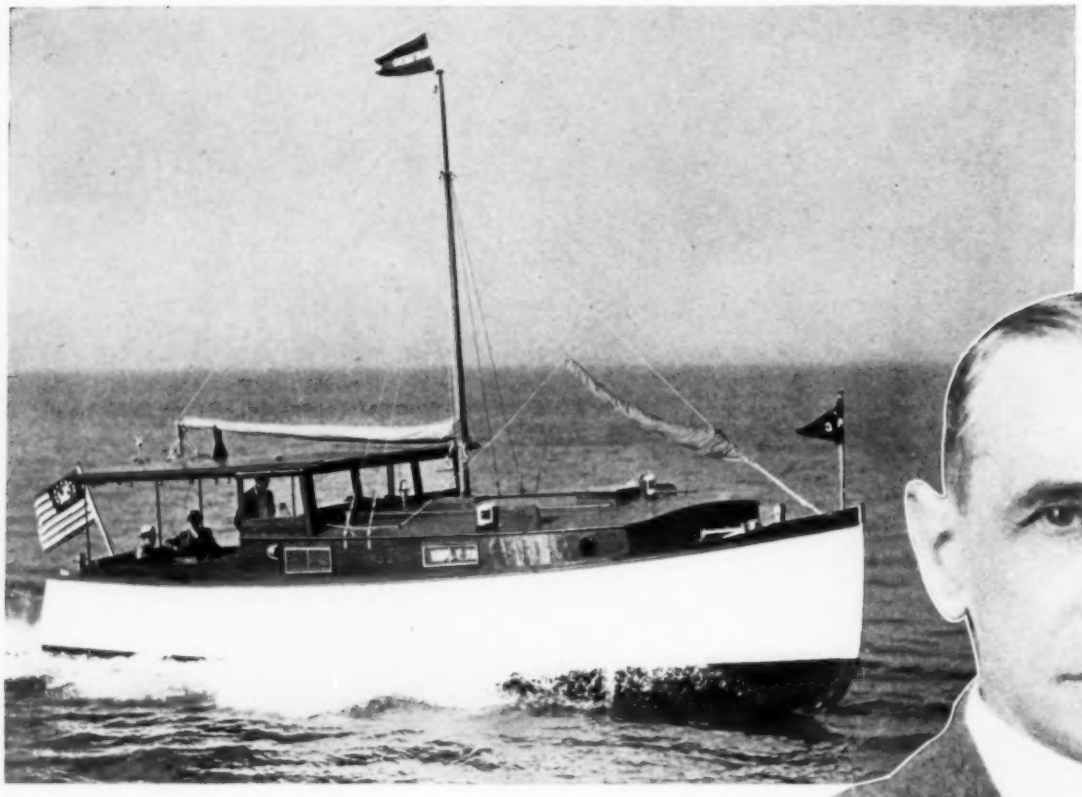
By G. W. Burrell
President and General Manager,
The Wellman Engineering Co.
Cleveland

Co-operation in Design Aids Heavy Machinery Industry

IN THE manufacture of bulk-material handling machinery, such as the Wellman automatic ore unloaders, car dumpers, bucket-handling gantry cranes, and steel plant equipment such as charging machines, the trend in recent years has been to eliminate where possible built-up casting members substituting therefor larger unitary members which do not require the many machined adjoining surfaces, nor the material and labor which is involved in the assembling of such parts with bolts, nuts, washers and cotters. This change, we find, has brought about a ruggedness of construction which better enables our equipment to successfully withstand the severe punishment it receives due to the modern speeding-up production methods so typical of the times. In this connection, the foundries play an important part; somewhere in every machine there is a place where castings perform some function better than any other material, and the foundries are in a position to recommend castings having the proper characteristics for their jobs—in some cases the new alloyed materials for wear resistance, or high tensile strength for hard service. When large or intricate castings are involved, the foundries are sometimes consulted as to the best method of molding, and with this knowledge we can then co-operate by furnishing patterns adapted to the molding method proposed, to insure good castings. A typical example of such a unitary casting is shown in the accompanying illustration. This one-piece steel casting is approximately 17 feet 4⅜ inches long, 12 feet 5 inches wide, 6 feet 6 inches high and weighs 36,260 pounds and replaced five major castings used in earlier designs. Without the co-operation of the foundries this change in the details of our heavy type of equipment could not well have been accomplished.



This Single Casting Replaced Five Smaller Ones



By S. J. Matthews
President, The Matthews Co.
Port Clinton, Ohio

All Pleasure Craft Utilize Many Castings in Construction

IT IS not often that those of us who have for a period of years engaged themselves in the designing and building of pleasure boats are confronted with the realization of the important part which foundry work plays in the proper building of an able and seaworthy boat.

Some few weeks ago, upon reflection concerning the purport of a call I had from an individual from Philadelphia, I was almost shocked at the realization of what The Matthews Co. itself had accomplished in connection with brass and bronze foundry products.

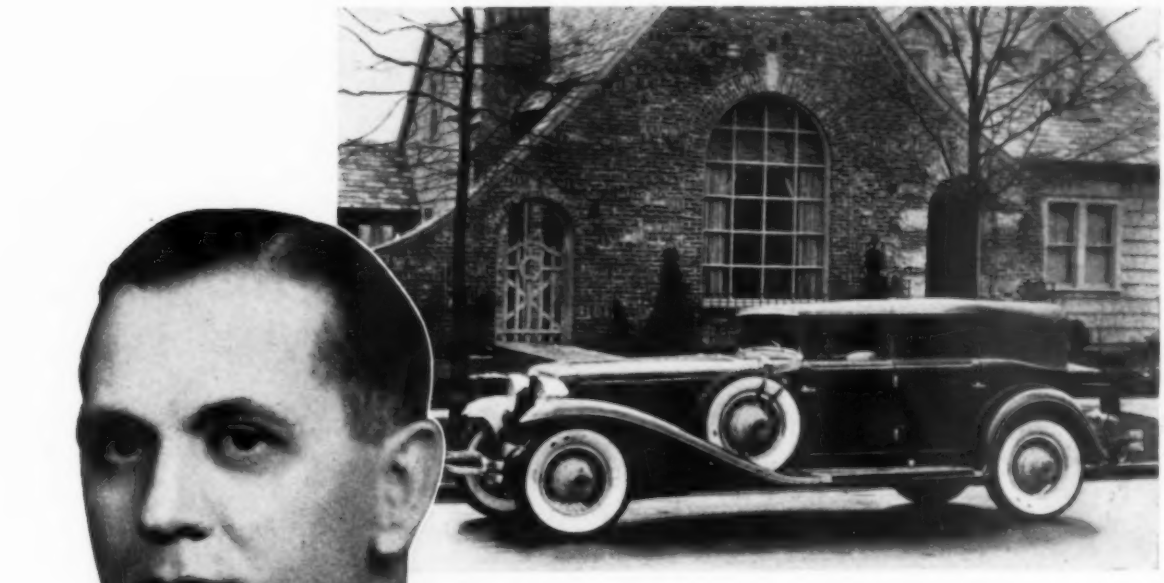
The Matthews Co. was requested to release to the marine hardware trade of the country a great many pieces of equipment which we ourselves had developed specifically for our line of stock cruisers, and upon investigation I discovered that, through a gradual process of designing, patterning, etc., we had come to the point of having developed about 80 per cent of all of the hardware used on our stock models, and there remains but 20 per cent that we are buying already made up elsewhere.

From the smallest fittings of a tiny bronze cleat to big heavy bearing housings with heavy reinforced skegs, castings of every kind and character are used in boat construction. In fact, in every motor installation and in every different model of boat it is necessary to have a special water jacketed exhaust connection patterned and cast to make the job proper and complete.

It is a revelation to the average man interested in foundry work to learn of the tonnage of castings used annually by boat building institutions, such as our own. Normally, the castings are not of great proportions or weights individually, but when the volume of them is figured up they run into a sizeable consideration.

In our plants alone we require an extremely large machine shop, a staff of machinists for nothing more than machine work and handling of these special castings made for our use.

In the past practically all of the cast fittings used by boat builders have been fashioned from brass and bronze. However, we are already putting to use cast stainless steel, and the public becoming more and more familiarized with stainless steel is beginning to question us about it and its use in their boats in salt water. We can foresee a time when much of the exterior hardware on pleasure craft is going to be of a bright non-tarnishing metal such as the materials now known as stainless steel.



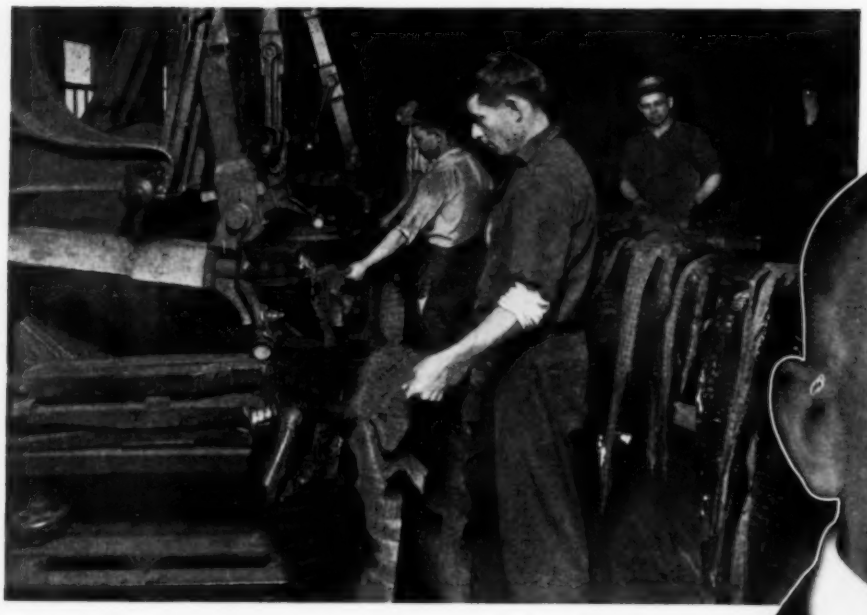
By E. L. Cord
President, Cord Corp.
Chicago

Heart of the Automobile Displays Foundry Ingenuity

NO BUSINESS or industry can stand still. It must either progress or retreat, and with the changed conditions, come added requirements.

The position which the automobile industry has reached has been made possible in a large degree by the advancements made by metallurgists. Improved metals have meant improved automobiles.

To the foundry the automobile manufacturer must turn for the heart of his product, the engine. Introduction of alloys has done much to increase the service of castings, to lighten weights, and to add to tensile strength. What has been done to date is commendable, but metallurgists cannot rest on their oars. They must continue to develop and seek out the unknown, to find new ways to make their product serve better.



By Fraser M. Moffat
President,
Tanners Council of America
New York

Castings Are Essential To Production of Leather

MAYBE the first leather makers had very little use for iron in any of its forms—certainly they had not learned anything about cast iron.

The use of leather for various purposes is, of course, as old as history. The methods of making leather have improved with civilization. The past 50 years have, in the leather industry, shown almost a complete revolution in processes, and in the effectiveness of the response of the producers of leather to meet the demands of a highly civilized society.

Leather is unique in that it reaches the consumer in somewhat the same elemental form that it had in its raw material. In the process of tanning, hides and skins do not lose the original shape in which they first came as raw material. Their structure, however, completely changes due to the processes used which make a very crude and unattractive object into sometimes a very beautiful, and always a highly essential, product.

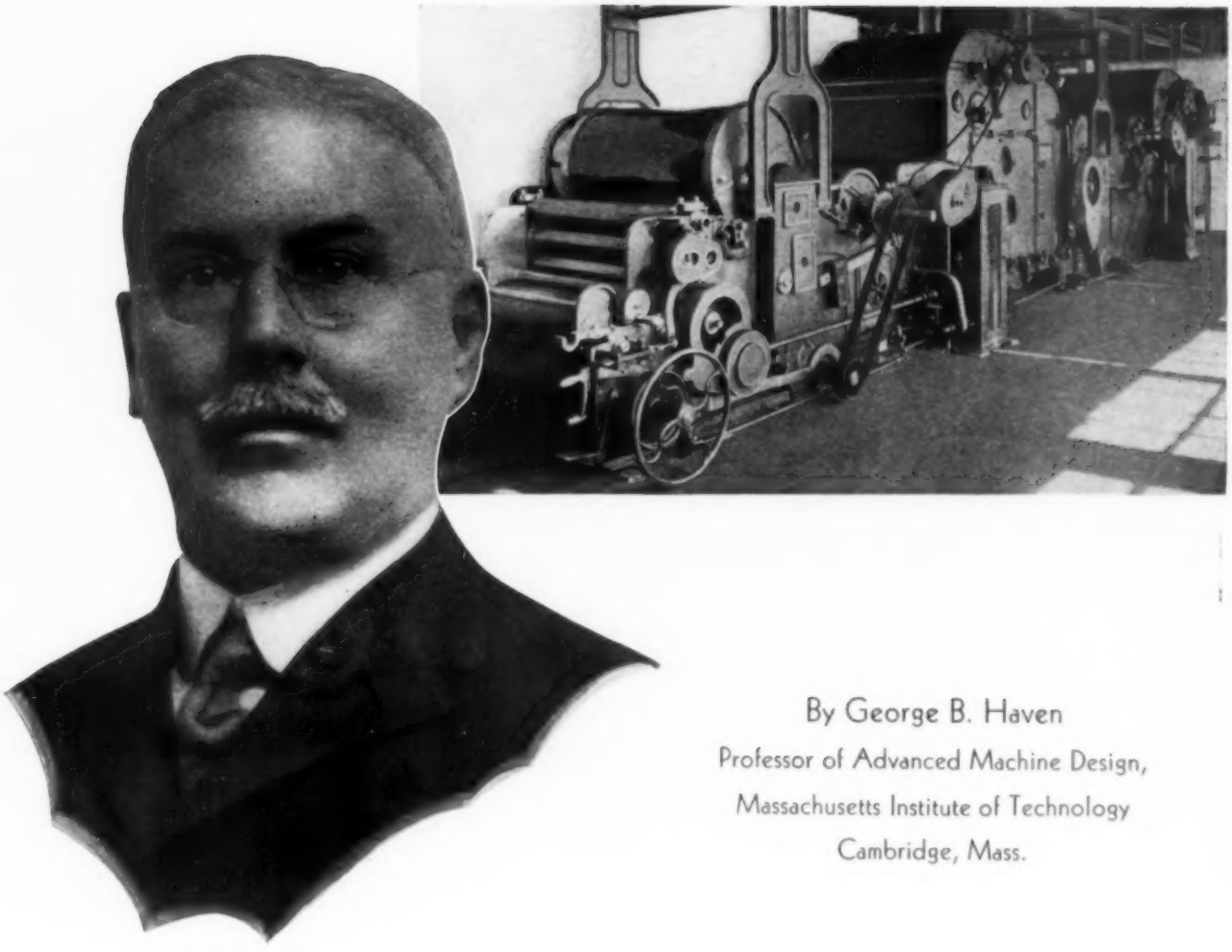
No complete substitute has ever been devised by man's ingenuity to take the place of leather; in this case science has not yet duplicated what nature accomplishes so well.

In the manufacture of leather, however, machinery today plays a great part, and this machinery varies from heavy structural type to the most delicate and sensitive mechanical devices. The service of the foundryman is called in at every point—in fact a tannery could hardly be run unless there were a foundry within easy reaching distance. The variety of machinery ranges from the permanent equipment necessary for the production and transmission of power, to the application of that power upon the particular hide or skin. We are unable to get very far from the foundryman with any degree of success.

In the development of leather products, which are innumerable, the foundryman plays a substantial part and his ingenuity has developed a strong ally to the leather industry as it has to other industries.

It is customary to refer to the leather industry as an old industry—it is better to refer to it as an industry which daily renews its youth.

Originally an animal substance nurtured by the soil, leather has a somewhat common base with metals. After all the soil is the source of all strength, and we are glad to offer an appreciation of the debt which the leather industry owes to mechanics and metals, and particularly to the foundryman.



By George B. Haven
Professor of Advanced Machine Design,
Massachusetts Institute of Technology
Cambridge, Mass.

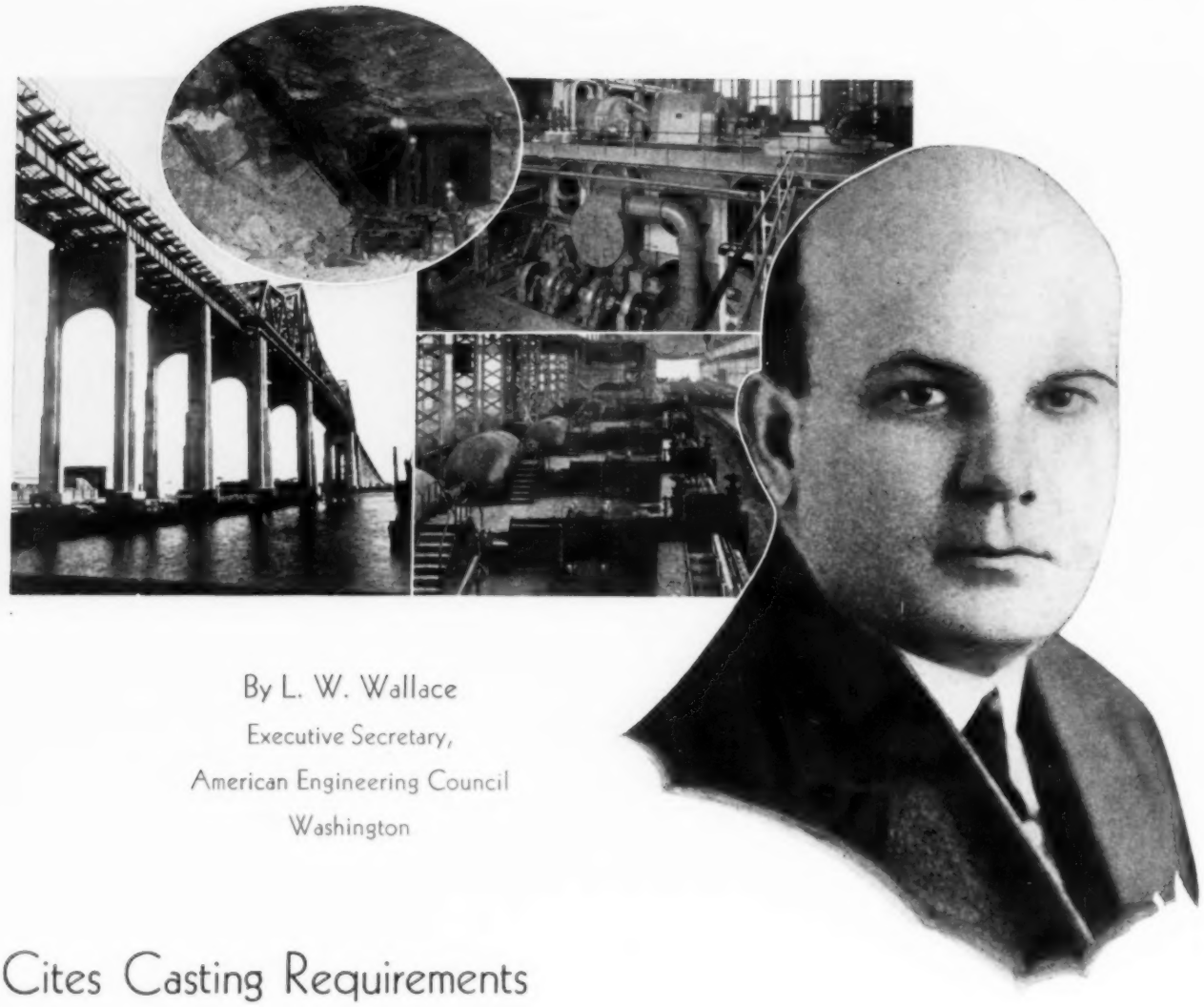
Textile Industry Close Ally of the Foundry Industry

THERE is probably no branch of machine manufacture calling for a higher degree of excellence in foundry work than the appliances used in the fabrication of textiles. The development of fiber manipulation has, of course, been the outcome of centuries of endeavor and inventive genius. It is natural, therefore, that such processes should be highly specialized and should call for very exact and precise procedure. It is interesting to note that with the present-day cry for simplification and consolidation of processes, the textile industry seems to have followed just the reverse. Whenever any concern goes out to simplify and eliminate processes in this line of work, it generally results in still more complication and extension, but naturally with much more excellence and speed.

The production of a simple piece of sheeting calls for 14 different textile processes, each one of which may contain two or three composite sections to make up the final machine. From this it is seen that the actual number of mechanisms employed even in the production of such a simple textile as plain cotton cloth runs at least to 30 or 40. Naturally, such extended manufacturing processes necessitate almost numberless forms of mechanical elements and make it necessary to duplicate machine parts in great numbers. While the die press and forming machine have been successful to a limited extent in shaping the parts of textile machinery, naturally the foundry is the greatest producer and the most successful originator of small duplicated machine parts. For this reason, the molding machine is a very important accessory to any foundry engaged in the production of textile machinery. A cotton card, for instance—only one of the items in the above 30 or 40 machines engaged in the production of plain cotton cloth, contains in its make-up a long chain of *flats*. The latter, as the name signifies, are long flat beams, very light and accurately formed, which hold the wire clothing of the card. These flats must be made of light weight but of great rigidity, and of much uniformity. They are, therefore, an A1 foundry product, made in great numbers by duplication, and actually form the backbone of the most important process in textile manufacture.

The greatest need of the textile industry is a further extension of molding machine work, embracing yet more and more of the complicated forms of textile mechanisms and at the same time incorporating far greater speed in their production. A well known manufacturer of looms once stated that his excellent product was 80 per cent a foundry production, meaning thereby that he had so designed his weaving machinery that any well made iron casting was entirely suitable for a large percentage of the parts of his looms. The actual amount of machine tool work in finishing these castings was reduced to a

(*Concluded on Page* 110)



By L. W. Wallace
Executive Secretary,
American Engineering Council
Washington

Cites Casting Requirements For All Engineering Progress

THE influence of machinery upon the well-being of workers and of society is a current topic of discussion in the smoking car, legislative halls, the press, and the drawing room. Many go so far as to say that the use of machinery has materially contributed to unemployment and therefore has been a detriment to society. Someone has suggested that science and all it connotes should take a 25 year recess. These and similar expressions are a challenge to technical men and to industry—a challenge to show whether their activities have been detrimental or beneficial to society.

A convincing answer cannot be given until a thorough, fair-minded and exhaustive study has been made of the actual bearing of the use of machinery upon employment and the social fabric of the nation. To date no one has assembled sufficient facts relating to this subject, hence a large amount of prevalent discussion has been without substance.

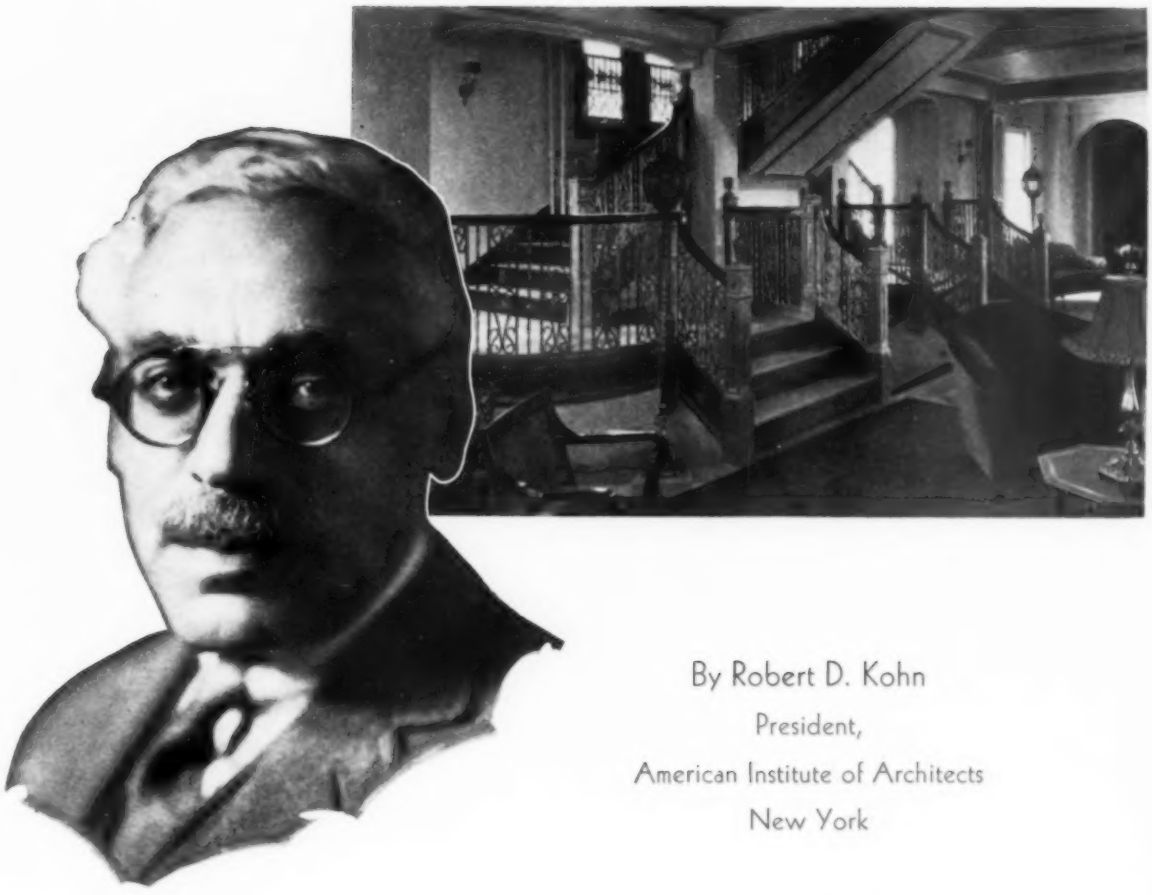
The engineering profession and those engaged in foundry operations cannot afford to ignore the trend of thought existing with reference to the use of machinery and its bearing upon economic and social progress, for the very evident reason that these two groups are exceedingly important factors in the production of machinery. The engineer designs the machinery and the foundryman provides its vital parts through the castings he produces. Without designs and castings there would be little machinery of consequence. The remarkable development in the processes and products of the foundry in recent years has made possible the design and production of new and improved machinery and appliances which have revolutionized former modes of living.

A few moments devoted to a mental inventory would convince any reasonable and fair minded person of the important part castings play in modern life, and that to remove them would be little short of a catastrophe. Such a mental inventory would demonstrate that without castings modern transportation would not be available to the masses at a cost they could afford, since to remove castings from the locomotive, the freight and passenger car, the steamboat, the motor car, the truck, the airplane, would practically eliminate all modern means of transportation.

The removal of castings from the farm and farm house would result in appalling havoc. There would go all major farming implements, the pump, milking machines, the cream separator, not to mention such labor relieving appliances as hoisting, grinding and cutting equipment. In the farmhouse the cook stove, the washing machine, the refrigerator, the vacuum cleaner, aluminum ware, the electric iron, and countless other conveniences, would no longer be present to relieve the drudgery of the housewife.

The absence of castings from modern life would mean that homes everywhere would be deprived of the bathtub, the kitchen sink, and a thousand and one bric-a-brac both useful and decorative. Even feminine pulchritude

(*Concluded on Page* 109)



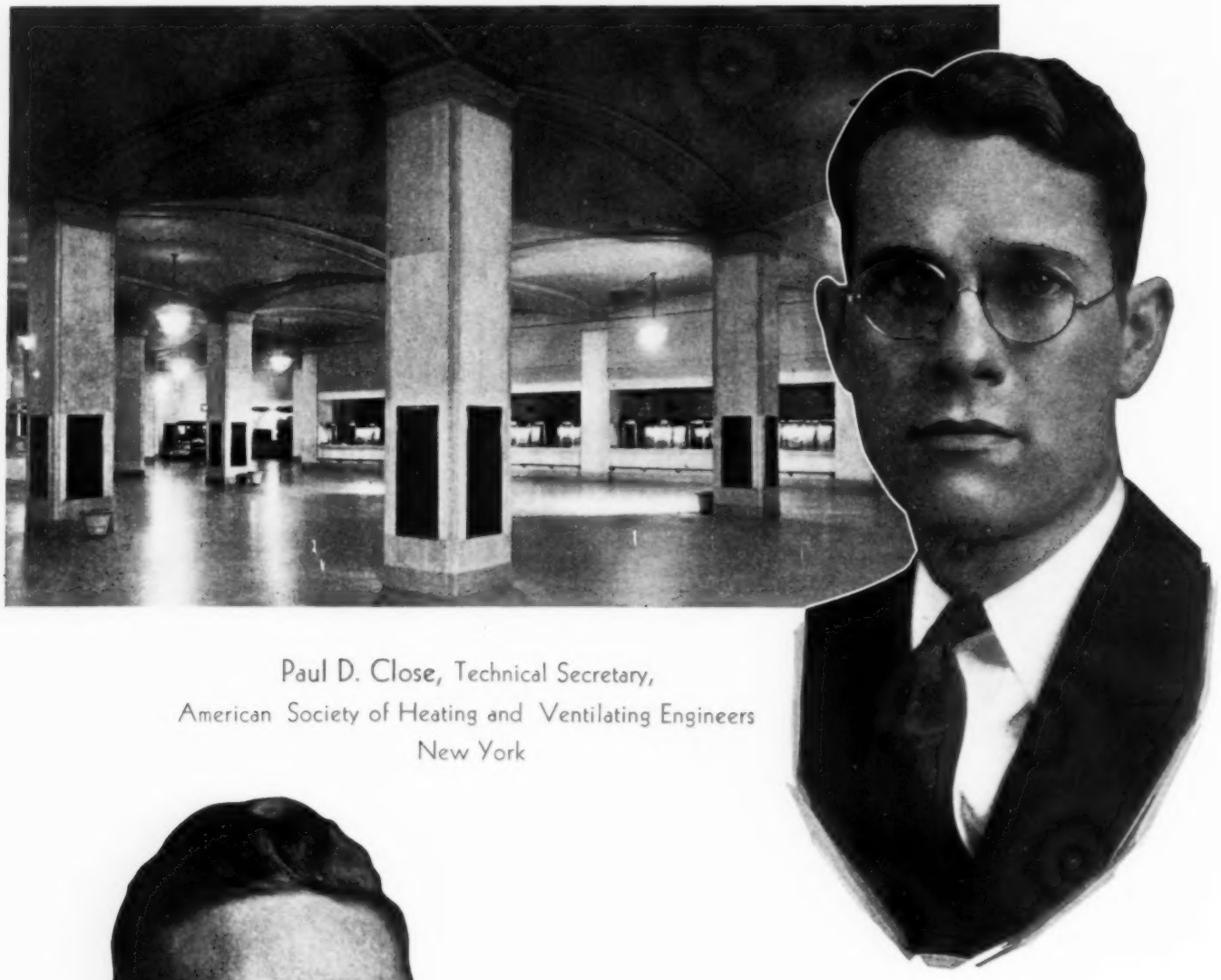
By Robert D. Kohn
President,
American Institute of Architects
New York

Architects Take a New Interest in Use of Cast Metals

IT SEEMS to me that the architects of the country have awakened to an entirely new interest in the work of the foundryman, since the introduction of so many new and interesting metals and alloys. Aside from the structural uses of cast iron, there was no interest in the building industry a few years ago in castings, except in the limited field afforded by spandrel sections at the floor levels of high buildings. While these were still used, there was a tendency among architects to turn to burned clay materials because of certain inconveniences connected with the use of cast iron.

But now all this is changed. Castings are offered to us in many metals and different combinations of metals or alloys much more interesting in texture, color and finish than anything we had before. It seems to me that the next few years will see a great development in the use of such castings in a decorative way in architectural design. Already there is evidence of that development in modern buildings going up all over the country.

Doubtless something has already been done by the foundrymen in the direction of a co-operative effort to inform the designers including the architects of the possibilities of the uses of cast metals in their new work. The variety of such uses that might be developed would certainly justify some form of intelligent and informed research and resulting propaganda. As architects we certainly need to know what can be done with these metals in their cast form and what possible finishes can be produced. There must be in this an interesting new field to be followed up by an organization like the American Foundrymen's association. If their research and propaganda are done with intelligence and taste, they will certainly result in a greatly increased use of castings and a much more worthwhile and interesting aesthetic development of such uses.



Paul D. Close, Technical Secretary,
American Society of Heating and Ventilating Engineers
New York

R. V. Sawhill
Editorial Director, Domestic Engineering
Chicago

Points to Castings Used In Heating and Ventilating

By Paul D. Close

DEVELOPMENT of knowledge concerning the factors entering into the proper heating and ventilating of buildings has necessitated the co-operation of the engineer, the physiologist and the physician. Almost any desired atmospheric condition of temperature, humidity, air motion, cleanliness, etc., can now be produced within a given enclosure. The control of these factors is sometimes called air conditioning.

The aim of the American Society of Heating and Ventilating Engineers is the solution of fundamental heating and ventilating problems through meetings, discussions and investigations at its research laboratory, at present located in the United States bureau of mines building at Pittsburgh. Co-operative research investigations are also carried on at various universities throughout the country. One of the most far-reaching problems under investigation by the society is the relation of temperature, humidity and air motion to comfort and health. This work has been under way for several years, and has been carried on in co-operation with the U. S. public health service and the Harvard school of public health.

Few people realize the ramifications of the art of

heating and ventilation. It involves the developed knowledge of not only the heating and ventilating engineer, but also the chemist, the physicist, the physician, the climatologist, and many others.

The foundry plays an important part in this vital industry, for there is hardly a heating and ventilating installation of any type in which castings in some form or other are not used.

Conditioned Air Occupies Important Role in Buildings

By R. V. Sawhill

THE interest shown in the advantages of air conditioning by industrial plants of all kinds, office building owners and tenants, public institutions such as government building, hospitals, hotels, theaters and other large structures appears to be increasing steadily. Home owners, too, are installing forced ventilation systems with provisions for cooling, cleaning, humidifying and dehumidifying the atmosphere. The summer of 1930 witnessed the successful application of air conditioning systems to railway cars; the field for air conditioning can probably be defined as including any enclosure where the atmosphere affects the comfort of human beings or the processing of materials.

Recently, the *Chicago Journal of Commerce* predicted editorially that refrigeration and radio are the two industries which will show the largest development in the next few years. Air cooling and dehumidification represent a sizable portion of the refrigeration business, of course.

It is of interest to note that a windowless industrial plant is being constructed; it is to be provided with an air conditioning system. A large laboratory building has been completed recently in the Middle West, the walls of which are largely glass; it, too, is air conditioned. Apparently no matter what the trend our future buildings will follow, air conditioning will play an important role.

The foundry has an essential part in the job of producing the equipment necessary for this large and growing industry. Its castings are used in the construction or manufacture of fans and blowers, refrigeration machines of all types, the necessary pumps, air washers, air filters, for valves and other regulating and controlling devices, for boiler, heating and cooling sections, and the many other products which form the parts of air conditioning and heating systems.

It would seem that the inevitable and apparently rapid increase of the air conditioning industry will necessarily mean the utilization of growing quantities of castings of many kinds.

Cites Casting Requirements For All Engineering Progress

(*Concluded from Page* 106)

would suffer because of the absence of the curling iron.

To take castings out of civilization would be to impoverish it in an artistic sense. Many uses of bronze would no longer be possible. Many features, both artistic and utilitarian, of modern construction and architecture would be out of the question. The beauty and grandeur of cathedrals, palaces, and temples of business would be materially lessened.

Among the marvels of the age are the efficient and satisfying means of communication—the telegraph, the telephone, the radio, and television. Were it not for the use of castings in this connection, we would still be living in an era of wigwags.

Those familiar with the foundry of half a century ago know something of the tremendous burden that has been lifted from the backs of men through the use of machinery. In those days the physical effort required to do the daily tasks about the foundry was terrific. Then, too, the insufferable heat, the dirt and dust shortened men's lives and lessened their earning capacity. Today the modern foundry is characterized by highly specialized and precise equipment—equipment which has removed untold drudgery and greatly lessened the danger to life and limb of those who work in foundries. In addition, the use of machinery has enabled foundries to make castings for innumerable products at a cost which has made available to humanity many modern conveniences and necessities. It would indeed be a prejudiced mind which would fail to evaluate highly these results in terms of the economic and social well-being of mankind.

The engineer and the foundryman have been partners in this accomplishment. The engineer has developed the designs, the foundryman has made the castings and used the machinery. To the degree these activities have contributed to the advancement of civilization, to that degree may the engineer and the foundryman merit and claim a measure of credit.

In like manner, they are partners in the realm of responsibility. They cannot escape the responsibility for any ill effects growing out of their activities. It is the obvious duty of those associated with the design, construction and operation of machinery to weigh conscientiously the social consequences of their work. To do so is not to be socialistic nor communistic, but rather to be wise, far-seeing and humane. If this obligation is met fully, then machinery in the future will be an even greater instrument of economic and social progress, than it has been in the past.

Road Building Machinery Employs Large Casting Tonnage

(*Continued from Page* 88)

well over this figure. In 1923 a record of 2017 feet of 18 foot concrete in a day was announced by the Illinois division of highways, a seven bag mixer being utilized.

The same development is evident in all types of machinery used in the construction and maintenance of highways. Daily output of asphalt plants have been increased in the last 10 years from 100 tons to a maximum of 1400 tons.

Development of road building equipment has resulted from competition among users, competition among manufacturers, influence of automotive engineering and improved methods of highway financing, which latter has made mass production possible.

The total expenditures on state, county and township highways in 1904 amounted to $60,000,000. In 1914 this amounted to $240,000,000, in 1924, $1,075,000,000 and in 1929, $1,700,000,000.

Bonding operations for highways are no longer dependent on real estate taxes for amortization but are predicated on the gas tax. Vehicle taxes are not only gradually relieving property owners from burdensome

Motor driven highway machinery has been developed with a comparatively brief period of time. Multiple cylinder engines were not in general use prior to the beginning of the last decade.

Research by the automotive engineer has been largely responsible for this development. Horse drawn equipment was in many instances replaced by steam as a

motive force and this in turn has been largely supplanted by the multicylinder gasoline motor. Machinery which has been greatly improved by this change includes trucks, tractors, motor graders, elevating graders, power shovels, road rollers and pavers.

During this same ten years quality and kind of material has been greatly improved. Today, malleable iron has nearly twice the strength that it had before the war and there is more use of alloy steels, heat-treated steels, cast steel, and other high grade material, where formerly highway machinery was mainly built of poorer material, structural shapes, standard steel plate, and forging from ordinary steel.

The result is better machinery at lower cost, also better highways at lower cost and cheaper maintenance. Regardless of business depressions, highway development continues to expand, and results in an ever increasing market for highway equipment. With a steady increase in funds permitting a large volume of business, improvement in design and quality will continue.

The market for highway equipment includes state, county, city and township highway organizations, and the contracting industry. State highway purchases alone approximated $17,000,000 in 1930.

The adoption of American methods in European and Pan American countries is paving the way for an enormous potential market for American made machinery in future years.

Textile Industry Close Ally of the Foundry Industry

(*Concluded from Page* 105)

minimum and consisted mostly of drilling, tapping and surface grinding. Of course, such a possibility means great economy in the production of textile machinery.

In order to gain greater speed in textile working, it is necessary to use better gears. The usual process has been to make a large percentage of textile gears simply green sand castings. With these suitable pickled and snagged, and possibly hand-finished in a minor respect, there has proved to be enough accuracy for many of the slower moving gears in textile machinery. It is to be hoped that in the future the use of helical or so-called spiral gears will be greatly increased in fiber-working machines. Of course, it is very expensive to cut such gears, but their action is much quieter and more uniform than plain spur gears. Is it not possible that the foundry may develop molding machine methods of casting helical gears of greater accuracy and consequently much more precision and quietness in operation?

Shipbuilding Industry Closely Linked to the Foundry

(*Concluded from Page* 90)

River Plate that lost six weeks time in a detour of 600 miles because of a safety valve casing burst due to a defective casting on account of the core having been placed off center.

A revival in shipbuilding is now underway in the United States, due to the direct effect of the merchant marine act of 1928, popularly known as the Jones-White law. Under this law the post office department is empowered to enter into mail contracts with American lines on certain routes in foreign trade calling for substantial payments to the operators.

Shipyards in the United States are now building over 100,000 tons more than they were before the war. The share of the United States in world shipbuilding advanced from 8.3 per cent at the end of last September to practically 10 per cent at the end of the year and it is still on the increase. On March 1, there were some 26 vessels for foreign trade, costing in the aggregate $116,838,324, under construction in American shipyards, and in addition five vessels are being constructed for overseas trade at a cost of $8,838,850. In addition to this program, already under way, some 27 vessels aggregating 290,272 gross tons are yet to be contracted for and built in accordance with mail contracts already awarded. Also some 21 vessels of 125,000 gross tons may be classed as probable future construction.

Considerable shipbuilding in addition to the foregoing is also under way for private American interests independent of mail award requirements. Naval shipbuilding, represents a reasonable volume of work, most of it in navy yards, though one light cruiser at a cost of $10,450,000 was awarded on Feb. 14 to the New York Shipbuilding Co. A detailed resume of shipbuilding under way and future prospects will be found in the *Marine Review* for March.

Foundrymen Contribute Products to Empire State

(*Concluded from Page* 87)

lent to 102 ordinary 12-foot stories. A total of 58,000 tons of structural steel, equivalent in tonnage to sufficient rails to build a double track railroad from New York to Montreal, was employed in the construction. Fifty miles of temporary water pipe were installed for construction purposes alone. The floor space is sufficient for a city of 80,000 people, and seven miles of elevator shafts are served by 62 elevators.

A few facts relative to castings requirements are indicative of the close alliance between the building construction and foundry industries. Sash weights for the windows total 450 tons while the locks, latches, bolts and builders hardware weigh in excess of 80,000 pounds. Mail boxes and trim for mail chutes, all richly ornamented, take a large tonnage of nonferrous castings. Approximately 360 tons of aluminum castings went into the structure. A portion of these castings are in use in the tower mast and others form lintels and ornamental trim at various points. Ornamental gray iron castings total from 12 to 15 tons while the castings for tees, elbows and valves far exceed this total.

Mirroring an Industry

(*Concluded from Page* 81)

small coin in the slot of a cast vending device he is made the happy possessor of any one of a wide variety of articles ranging from a postage stamp to a wrapped choice cut of meat or a package of cigarettes.

The average citizen starts the day with a bath in an enameled cast-iron bath tub and shaves at an enameled cast-iron wash stand. The fittings on these devices are castings. Waste water is carried away in cast-iron soil pipe. His meals are cooked on a stove employing castings and the dishes afterward are washed in a cast-iron sink. His house is heated by cast iron stoves, grates or furnaces and the hot air, steam or hot water exerts its influence through cast registers or banks of cast radiators.

Under present conditions, the foundry industry plays an important role in the existence and progress of every person singly and collectively, from the cradle to the grave. From the iron mold in which the infant's nursing bottle is blown to the handles on caskets where age seeks its final repose, castings serve man.

Stevens Hotel, the Center of the Week's Activities

A. F. A. Offers Valuable Technical Program

TO CHICAGO goes the distinction of being the only city in the country to entertain the members of the American Foundrymen's association on six different occasions. In 1900, just five years after the birth of the association, the members met for the first time on the shores of Lake Michigan, and since that time, conventions were held in Chicago in 1912, 1913, 1927 and 1929. The thirty-fifth annual convention and exhibition, the climax of association activities, will be held from May 4 to 7 in the Stevens hotel, the scene of the most successful meeting in 1929.

From the opening on Monday, May 4, until the close of the meeting at 6 p.m. on Thursday, May 7, foundrymen attending the A. F. A. convention and exhibition will be provided with a program of technical sessions, round table meetings and shop operation courses, which should surpass in interest and value those of previous meetings. The sessions are planned to provide papers and discussions for all branches of the industry, and will appeal to executives, engineers, metallurgists and shop men. In addition to the meetings, a splendid group of exhibits of foundry equipment and supplies will be on display in the exhibition halls of the Stevens hotel, the center of the week's activities.

The Chicago district, the largest foundry center in the country, will provide many points of interest for those wishing to spend a part of their time in plant visitation. A committee of Chicago foundrymen will maintain headquarters in the Stevens hotel to give information regarding hours for visitation and transportation facilities.

Special entertainment features also will be provided for the ladies attending the convention. Tentative plans call for a luncheon and style show at Marshall Field & Co., visits to the Shedd Aquarium and Planetarium, both completed since the 1929 convention in Chicago, and a visit to the studios of the National Broadcasting Co. located in the new Merchandise Mart, the largest office building in the world. This part of the program is being arranged by a committee of Chicago ladies.

The annual exhibitors dinner is scheduled for Monday evening. On Tuesday evening, instructors of engineering schools will hold their annual dinner. This feature of the convention has been growing in interest and it is expected that the attendance will exceed that at recent conventions. The annual banquet, to which the ladies of course are invited, will be held on Wednesday evening. Hugh Morrow, President, Sloss-Sheffield Steel & Iron Co., Birmingham, will act as toastmaster at the banquet.

At the general opening meeting on Monday, the exchange paper of the Institute of British Foundrymen will be presented. This paper, by V. C. Faulkner, editor, *Foundry Trade Journal*, will present an interesting review of the British foundry industry. An interesting lecture has been secured for

the business session on Thursday. Col. T. C. Dickson, commandant of the United States Arsenal, Watertown, Mass., will talk on "Centrifugal Casting of Guns," one of the outstanding developments in ordnance production. Details of the program are given in the accompanying box.

The committee on foundry costs will have two interesting reports to present for discussion. The committee on methods for determining molding costs has made a survey of the practices used throughout the country and the data secured will be presented at the meeting. The committee making the survey consists of W. J. Grede, Liberty Foundry Co., Wauwatosa, Wis., W. J. MacNeill, Federal Malleable Co., West Allis, Wis., and C. S. Wieland, Milwaukee Grey Iron Foundry Co., Milwaukee.

The second committee report will be on data which should be furnished by the purchaser of castings when requesting estimates. The committee which has been formulating a standard for this material is composed of the Chairman, R. E. Belt, secretary, Malleable Iron Research institute, Cleveland, J. L. Wick, Jr., Falcon Bronze Co., Youngstown, O. Charles Seelbach, Forest City Foundries, Co., Cleveland, and W. J. Corbett, Fort Pitt Steel Casting Co., McKeesport, Pa.

The nonferrous cost committee will have a session devoted to discussing nonferrous foundry cost methods. E. A. Baker, cost accountant, New York, will give a talk before this meeting, discussing weak points in cost systems.

Five shop operation courses are scheduled for this year's convention, two more than for last year's meeting, as courses on sand control and malleable founding have been added. These courses, which have been established to give instruction in the fundamentals of shop practice, will cover, in addition to the two new courses, gray iron, steel and nonferrous founding.

The committee on gray iron founding, under the chairmanship of Max Kuniansky, Lynchburg Foundry Co., Radford, Va., has prepared a four-session course. Two sessions will be devoted to cupola operation and one each to gating and high test iron. R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, will lead the gating session, Dr. Fritz Meyer, Rockford, Ill., the high test iron session, and the cupola sessions will be in charge of P. T. Bancroft, John Deere Harvester Co., Moline, Ill., and J. Grennan, University of Michigan, Ann Arbor, Mich.

The committee organizing the steel foundry course consists of David

Tentative Program of Technical Papers

Monday, May 4

9:00 a.m.—*Registration*
10:00 a.m.—*Committee Meetings*
12:00 noon—*Exhibits Open*
1:30 p.m.—*Committee Meetings*
Shop Operation Course

Gray Iron (1st session) Subject: Gates and Risers.

3:00 p.m.—*General Opening Meeting*
Chairman—President N. K. B. Patch
Vice Chairman—Vice President E. H. Ballard

Address of President.
A Cross Section of the British Foundry Industry, by V. C. Faulkner, Editor, Foundry Trade Journal. Exchange paper of the Institute of British Foundrymen.

4:00 p.m.—*Committee Meetings*
4:30 p.m.—*Shop Operation Course*

Sand Control (1st session) Subject: Moisture Control.

7:00 p.m.—*Exhibitors' Dinner*

Tuesday, May 5

9:00 a.m.—*Shop Operation Course*

Sand Control (2nd session) Subject: Permeability and Fineness.

10:00 a.m.—*Gray Iron—High Test Alloy Cast Iron and Testing*
Chairman—James T. MacKenzie

Manufacture and Use of Cupola High Test and Alloy Irons in a Machine Tool and Jobbing Foundry, by L. M. Sherwin and T. F. Kiley, Brown & Sharpe Mfg. Co., Providence, R. I.
Testing Cast Iron, by Major Nicolau, Paris, France. Exchange paper of the French Foundry Technical Association.
A New Type of Inclusion in Cast Iron and Its Relation to Manganese and Silicon Content, by F. J. Cook, Birmingham, England.
The Effect of Soaking Time on Initial Temperature and Analysis by W. H. Spencer and W. M. Walding, American Cast Iron Pipe Co., Birmingham, Ala.

10:00 a.m.—*Malleable—Metals and Melting*
Chairman—F. M. Robbins
Vice Chairman—E. E. Griest

Thermal Balances of Melting Furnaces and Production Costs in Malleable Foundries, by J. H. Hruska, Berwyn, Ill.
Report of Representatives on Joint Committee on Refractories, by J. R. Allan, International Harvester Co., Chicago.
Reports of Committees.

10:00 a.m.—*Nonferrous—Foundry Costs*
Chairman—J. L. Wick Jr.

Weak Points in Cost Systems Which Permit Leakages, by E. A. Baker, E. A. Baker Corp., New York City.

10:00 a.m.—*Pattern Production Round Table*
Chairman—Vaughan Reid

12:15 p.m.—*Malleable Luncheon and Round Table*
Chairman—R. E. Bryant
Vice Chairman—P. C. DeBruyne

2:00 p.m.—*Foundry Costs*
Chairman—A. E. Haceboeck
Vice Chairman—W. J. Grede

Report of Committee To Formulate Data Which Should Be Supplied When Estimates Are Requested
Report of Committee on Methods of Determining Molding Costs.

2:00 p.m.—*Sand Research*
Chairman—R. F. Harrington
Vice Chairman—V. A. Crosby

Shape of Sand Grains, by Dr. H. Ries and G. D. Conant, Cornell university, Ithaca, N. Y.
Relation Between Sand Grains and Strength of Sand, by Dr. H. Ries and H. V. Lee, Cornell university, Ithaca, New York.
Effect of Heat on the Permeability of Facing and Core Sands, by W. M. Saunders, Providence, R. I.
Some Observations on the Use of Synthetic Sands, by L. B. Knight, National Engineering Co., Chicago.
Reports of Committees.

4:00 p.m.—*Shop Operation Courses*

Steel (1st session) Subject: Shrinkage of Steel, Shrinkage Allowance, Distortion of Patterns, and Proper Heading and Gating.
Gray Iron (2nd session) Subject: High Test Cast Iron.
Malleable (1st session) Subject: Melting Practice.
Nonferrous (1st session) Subject: Fluidity and Shrinkage as Factors Affecting Gating.

7:00 p.m.—*Dinner—Instructors of Engineering Schools*

Wednesday, May 6

9:00 a.m.—*Shop Operation Course*

Sand Control (3rd Session) Subject: Bond Strength Control.

10:00 a.m.—*Gray Iron—Melting Methods*
Chairman—J. D. Stoddard

Melting Gray Iron and Malleable Iron in the Indirect Arc Furnace, by J. H. Vogel and J. C. Bennett, York Ice Machinery Co., York, Pa.

Zuege, Sivyer Steel Casting Co., Milwaukee, chairman, D. P. Spencer, Racine Steel Casting Co., Racine, Wis., and W. F. Wilson, American Steel Foundries, East Chicago, Ind. Three sessions have been planned for this group. These will cover shrinkage distortion of patterns and heading and gating, cleaning room practice and heat treating.

The nonferrous shop operation course committee, under the chairmanship of E. R. Darby, Federal Mogul Corp., Detroit, has planned three sessions. Serving with Mr. Darby on this committee are W. M. Marr, Ohio Brass Co., Mansfield, O. and D. E. Broggi, Neptune Meter Co., Long Island City, N. Y. The three sessions will be devoted to gating and risering. The first session will be given over to a discussion of the principles of shrinkage and the second and third to discussing applications of gating to the various types of the alloys.

The committee organizing the malleable course consist of A. M. Fulton, Northern Malleable Iron Co., St. Paul, Minn., chairman, Walter Ranis, Union Malleable Iron Co., Moline, Ill., and A. VanLantschoot, Iowa Malleable Iron Co., Fairfield, Iowa. Two sessions are planned for this, the initial course on malleable. Melting will be discussed at the first session and molding problems will be reviewed at the second meeting.

Because of the demand which has arisen for information on sand control, the committee on foundry sand research has formulated a four-session shop course on this subject to give the practical foundrymen instructions in the fundamentals necessary when sand control is being started in a medium or small shop. The committee in immediate charge of this course is composed of H. W. Dietert, U. S. Radiator Co., Detroit, W. Ranis, Union Malleable Iron Co., Moline, Ill. and L. B. Knight, National Engineering Co., Chicago. The first session of this course will be held on Monday afternoon, May 4. The four subjects, one of which will be taken up each day, are moisture control, permeability and fineness control, strength control, and sand losses.

An innovation for A. F. A. conventions will be the round table meeting on pattern production. A series of questions have been submitted for discussion at this meeting, which has been scheduled for Tuesday morning May 5. Vaughan Reid, president, City Pattern Works, Detroit, will preside.

In addition to the session on apprentice training, which is scheduled for Wednesday afternoon, May 6 the apprentice training committee will

(*Concluded on Page* 116)

To Be Presented at the Various Sessions

Electric Process Iron for Cylinder and Cylinder Head Castings, by H. E. Bromer, Standard Foundry Co., Racine, Wis.
A Hot Blast Cupola, by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.
Effect of Atmospheric Moisture on Cupola Operation by N. A. Moore, Piston Ring Co., Muskegon, Mich.

10:00 a.m.—*Nonferrous—Plant Methods*
Chairman—J. W. Bolton
Vice Chairman—D. H. Wray

Deep Etching of Brass as Applied to Gating Problems, by R. W. Parsons, Ohio Brass Co., Mansfield, Ohio.
Cupola Melting of Brass, by T. Mauland, International Harvester Co., Chicago.
Bronze Pressure Castings, by J. E. Crown, U. S. Naval Gun Factory, Washington, D. C.
Report of Committee on Recommended Practices.

10:00 a.m.—*Steel Founding—Metallurgy*
Chairman—J. H. Hall
Vice Chairman—F. F. Dore

Chemical Composition as Employed for Classifying Carbon and Alloy Steels for Castings, by Major R. A. Bull, Electric Steel Founders' Research Group, Chicago.
Some Metallurgical Points in Acid-Open-Hearth and Electric Steel for Castings, by F. A. Melmoth, Detroit Steel Casting Co., Detroit, Mich.

12:15 p.m.—*Steel Luncheon and Round Table*
Chairman—H. P. Evans
Vice Chairman—F. J. Stanley

12:15 p.m.—*Nonferrous Luncheon and Round Table*
Chairman—H. F. Seifert
Vice Chairman—F. L. Wolf

2:00 p.m.—*Apprentice Training*
Chairman—C. J. Fruend
Vice Chairman—F. W. Kirby

Getting A Community Apprenticeship Under Way, by H. S. Falk, Falk Corp., Milwaukee, Wis.
Related Instruction, by S. M. Brah, Tri-City Manufacturers' association, Moline, Ill.

4:00 p.m.—*Shop Operation Courses*

Steel (2nd session) Subject: Cleaning Room Practice.
Gray Iron (3rd session) Subject: Cupola Practice.
Malleable (2nd session) Subject: Molding Practice.
Nonferrous (2nd session) Subject: Gating practice with Reference to Aluminum Bronze, Manganese Bronze, Yellow Brass and Nickel Alloys.

7:00 p.m.—*Annual Banquet*

Thursday, May 7

9:00 a.m.—*Shop Operation Course*

Sand Control (4th session) Subject: Sand Losses.

10:00 a.m.—*Gray Iron—General Practice*
Chairman—H. Bornstein
Vice Chairman—W. J. Grede

Factors Which Influence the Surface Quality of Gray Iron Castings, by W. G. Reichert and D. Woolley, Singer Mfg. Co., Elizabethport, N. J.
The Microscope as a Tool in Investigating Cast Iron, by R. M. Allen, Bloomfield, N. J.
Report of Committee on Recommended Practices.
A Contribution to the Study of the Part Played by Phosphorus in Cast Iron, by J. Dessent and M. Kagan, Liege, Belgium. Presented on behalf of Belgium Technical Association.

10:00 a.m.—*Nonferrous—Plant Practice*
Chairman—Sam Tour
Vice Chairman—H. M. St. John

Molding Practice for Heat Treated Aluminum Alloy Castings, by L. H. Fawcett, U. S. Naval Gun Factory, Washington, D. C.
The X-Ray as a Tool for Improving Aluminum Alloy Foundry Practice, by H. J. Rowe and E. M. Gingerich, Aluminum Co. of America, Cleveland.
Permanent Mold Foundry Practice for Brass and Bronze Castings, by Henri Marius, Lenoir Car Works, Lenoir City, Tenn.

10:00 a.m.—*Steel—Plant Practice*
Chairman—Major R. A. Bull

A Comparison of Synthetic and Natural Bonded Molding Sands for Steel Foundries, by H. J. Cole, General Electric Co., Schenectady, N. Y.
Interrelationship of Pin Hole Trouble and the Low Ductility Problem, by George Batty, Steel Castings Development Bureau, Philadelphia.
Detecting Casting Defects by Radiography, Using Gamma Rays, by C. W. Briggs and R. A. Gezelius, Naval Research Laboratory, Anacostia, D. C.

2:00 p.m.—*Annual Business Meeting*
Chairman—President N. K. B. Patch
Vice Chairman—Vice President E. H. Ballard

Report of Officers and Committees.
Centrifugal Casting of Guns, by Col. T. C. Dickson, Watertown Arsenal, Watertown, Mass.

4:00 p.m.—*Shop Operation Courses*

Steel (3rd Session) Subject: Heat Treating Practice.
Gray Iron (4th session) Cupola Practice. Subject: Gates and Risers.
Nonferrous (3rd session) Subject: Gating Practice as Related to Red Brass and Aluminum Alloys.

5:00 p.m.—*Official Closing of Exhibits*

Representative Foundries in Chicago

Name and Address	Established	Metal Melted	Class of Castings	Daily Output in Tons	President or General Mgr.	Foundry Supt.
A. B. C. Pattern & Foundry Co. 4021 W. Kinzie	1922	Brass, Bronze & Aluminum		2	F. H. Sheridan	
Ace Foundry Co. 4349 W. Kinzie	1925	Brass & Aluminum	Steam Pressure, Ovens, etc.	3	E. N. Roth	Fred Rink
Acme Aluminum Foundry Co. 814 W. 75th St.	1922	Aluminum	X-ray Machines, Vending, Vacuum Cleaners, etc.	1½	S. B. Reihm	H. L. Ferguson
Advance Pattern & Foundry Co. 2734 W. 36th Place	1919	Aluminum	Jobbing	20	Nels Shoan	A. J. Peterson
Aermotor Co. 2500 Roosevelt Rd.	1888	Gray Iron				
Agate Foundries Inc. 1721 Maypole		Brass, Bronze & Aluminum	Jobbing	2	Paul Wachtel	John Meskan
W. D. Allen Mfg. Co. 566 W. Lake	1887	Brass, Copper, Zinc, Lead & Tin	Part of Industrial Plant		W. D. Allen	H. E. Meng
Alloys Foundry 1725 Walnut St.	1922	Monel Metal & Pure Nickel	Jobbing	2	C. B. Carter	Allen Erikson
Altman Brass Foundry Co. 834 W. 49th Place	1930	Brass & Aluminum	General Jobbing	¼–½	H. Altman	H. Altman
American Art Bronze Foundry 4921-31 W. Lake	1885	Bronze	Statuary		Alfred J. Berchem	
American Brake Shoe & Foundry Co. 332 So. Michigan Ave.		Gray & White Iron	Brake Shoes		W. B. Given, Jr.	
American Building Foundry Co. 2300 So. Springfield Ave.	1907	Gray Iron	Railway, Machinery, Structural & Misc.	25–30	V. J. Houha	James Blaha
American Car & Foundry Co. 2417 So. Paulina		Gray Iron	Railroad			
American Castings Co. 6843 So. Irving Ave.	1921	Aluminum	Jobbing	15	A. Rosset	R. Fisher
American Manganese Steel Co. 333 No. Michigan Ave.	1910	Manganese Steel	Jobbing	40	W. G. Nichols	Albert Spina
American Steel Foundries 410 No. Michigan	1903	Steel	Railroad	700	G. E. Scott	
Anderson Bros. 1388 Fulton	1878	Aluminum, Brass, Bronze & Copper	Jobbing	5	Frank A. Anderson	E. G. Swanson
Wm. B. Anderson Foundry Co. 1715 Carroll Ave.	1897	Brass, Bronze & Aluminum	Jobbing	1½	L. L. Schloss	James Coleman
Apex Pattern & Foundry Co. 5814 So. Wood	1927	Aluminum	Jobbing	½	C. Sand	S. A. Berglind
Appleton Electric Co. 1713 Wellington	1927	Malleable	Electrical, Jobbing, Agricultural	18	A. I. Appleton E. Hansen	Wm. F. Hoernke
Armour Institute of Technology 3300 Federal	1902	Iron, Brass, Bronze & Aluminum	Experimental	1	Dr. Howard M. Raymond	Charles L. Larsen
Arrow Pattern & Foundry Co. 2720 W. Lake St.	1918	Brass, Bronze & Aluminum	Jobbing	1½	Gus Erickson Fred Erickson	Frank Foreman
Atlantic Chandelier Foundry 1925 Elston Ave.	1921	Yellow Brass, Aluminum & Bronze	Ornamental	¾	J. Miller	Stanley Malinawski
Bastian Blessing Co. 240 E. Ontario	1908	Copper, Zinc, Lead, Tin, Aluminum	Valves & Fittings	3	L. G. Blessing	J. M. Hecht
E. A. Baumbach Mfg. Co. 1812-1818 So. Kilbourn Ave.		Gray Iron	Part of Industrial Plant			
Beardslee Chandelier Mfg. Co. 216 So. Jefferson	1898	Brass, Bronze & Aluminum	Lighting Fixtures	¾	F. R. Farmer	L. E. Dickey
Bendixen Foundry Corp. 2300 Bloomingdale Ave.	1894	Gray Iron & Semisteel	Jobbing	35	V. F. Bendixen	John F. Kenny
Birtman Electric Co. 4140 Fullerton Ave.	1925	Aluminum	Vacuum Cleaner	1–2	H. R. Butz	E. W. Wiehle
M. Brucker 814 No. Lincoln	1875	Gray Iron	Stove, Furnace & Boiler Repair Parts	3	J. Brucker	W. E. Furzland
Brumund Bros. & Hufker Foundry Co. 4406 Carroll Ave.	1924	Brass, Bronze & Aluminum	General Jobbing	3	J. Hufker	E. G. Brumund
Burnside Steel Foundry Co. 92nd & Kimbark Ave.	1916	Steel	Jobbing, Railway, Agricultural & Oil	18	H. F. Wardwell	W. E. Adams
Butler Street Foundry & Iron Co. 3424 Normal Ave.	1891	Gray Iron	Jobbing	25	M. Hinkens	P. Hinkens
H. W. Caldwell & Son 2410 West 18th St.	1900	Gray Iron	Part of Industrial Plant	30		William Dank
Calumet Brass Foundry 9362-68 Ewing Ave.	1920	Brass, Bronze & Aluminum	General Jobbing	2	J. Bernier G. F. Dolan	J. Bernier G. F. Dolan
Canedy-Otto Mfg. Co. E. End Ave. & Main, Chicago Heights	1896	Gray Iron	Machinery	10–12	Canedy Otto	Chester Miller
Central Pattern & Foundry Co. 3737 So. Sacremento Ave.	1926	Aluminum, Brass & Bronze	Jobbing	7	Frank P. Battle	William Zint
Chicago Aluminum Castings Co. 2647 Ogden Ave.	1910	Aluminum	Jobbing	1	H. E. Horton G. H. Horton	
Chicago Art Bronze Works 842 Exchange Ave.	1910	Bronze	Art Castings		W. J. O'Connor	R. J. Fay
Chicago Brass Works Inc. 220 W. Ohio	1915	Brass, Bronze & Aluminum	Jobbing	1½	P. S. Kelly	James E. Kelly
Chicago Faucet Co. 2712-22 No. Crawford Ave.	1901	Red Brass & German Silver	Faucets for Plumbing Fixtures	2	A. C. Brown	J. H. Gavin
Chicago Foundry Co. 2028 No. Major	1905	Gray Iron	Jobbing	25	I. H. Wells	C. F. Wells
Chicago Iron Foundry Co. 2315 W. Austin	1920	Iron & Aluminum	Jobbing	20	Richard H. Hausse	James Vevoda
Chicago Malleable Castings Co. 120th & So. Racine Ave.	1893	Malleable Iron	Railroad & Miscellaneous	52	J. T. Llewellyn	L. F. Hortwig
Chicago Railway Equipment Co. W. 46th & So. Winchester Ave.	1892	Malleable	Railway, Automotive & Jobbing	100	E. B. Leigh	E. E. Griest
Chicago Steel Foundry Co. 3720 So. Kedzie Ave.	1906	Carbon & Alloy Steels	Railway & General Industrial	20	David Evans	Joe Frank
Chicago Surface Lines 7741 So. Vincennes Ave.	1914	White Metals & Brass	Railway Car Parts	6	Henry A. Blair	H. H. Adams
Christensen & Olsen Foundry Co. 218 No. Racine	1878	Brass, Bronze & Aluminum	Jobbing	15	A. Christensen	A. O. Olsen
James B. Clow & Sons No. Talman Ave. & West Lake	1878	Brass, Aluminum	Plumbing, etc.	¾	W. E. Clow	Jay Miller
Coleman Bronze Co. 336 W. 37th	1893	Bronze, Aluminum & Iron	Architectural	12	Lawrence Dean	William G. Jones
Colonial Fireplace Co. 4617 Roosevelt Rd.	1906	Gray Iron	Ornamental	1½	W. W. Guy	G. W. Guy
Crane Co. 836 So. Michigan	1855	Brass, Steel, Gray Iron & Malleable	Part of Industrial Plant		R. T. Crane	
Cribben & Sexton 680 No. Sacramento Blvd.	1870	Gray Iron	Stove Plate	20	G. D. Wilkinson	W. L. Brown
Crom Die Cast Co. 908 No. Spalding Ave.	1929	Aluminum Bronze	Die Castings	2–3	T. Brodersen	Fred R. Meier
Crown Stove Works 4627-35 W. 12th Place	1908	Gray Iron	Part of Industrial Plant	7	W. F. Rogers	A. Kezel
D. G. Foundry Co. Twelfth St.	1921	Gray Iron	Jobbing	4	George Dawenis	R. F. Dawenis
William E. Dee Co. 30 No. LaSalle	1904	Gray Iron	Jobbing & Municipal	20	Wm. E. Dee	E. P. Smith

Representative Foundries in Chicago

Name and Address	Established	Metal Melted	Class of Castings	Daily Output in Tons	President or General Mgr.	Foundry Supt.
Delta Star Electric Co. 2433-53 W. Fulton	1927	Aluminum, Brass, Bronze	Jobbing, Railway, Bushings, etc.	10	H. A. Tracy	P. Malloy
Paul Dickinson Inc. 3306 So. Artesian Ave.	1901	Gray Iron	Jobbing	12	A. J. Filkins	
Eugene Dietzgen Co. Fullerton & Sheffield Ave.	1892	Brass, Aluminum & Bronze	Part of Industrial Plant		A. Langsner	A. Langsner
Dole Valve Co. 1923 Carroll Ave.		Brass	Automobile & Tube Fittings	2	F. H. Tweed	T. Corner
Eberhardt & Wagner 2011 Fullerton	1919	Brass, Aluminum, Bronze	Ornamental, Jobbing	1	Otto Wagner	Fred J. Eberhardt
R. M. Eddy Foundry Co. 372 W. Grand Ave.	1865	Gray Iron & Semi-steel	Printing Presses	35–45	Geo. A. Eddy	E. H. Simonsen
Electric Household Utilities Corp. 22nd & So. 54th St.	1929	Gray Iron & Aluminum	Washing Machines & Ironers	40	A. R. Nickson	N. Fanning
Electrocast Steel Foundry Co. 4707 W. 15th Place	1922	Steel	Jobbing	5	O. G. Peterson	Joe Barsevsky
Elizabeth Street Foundry Co. 5838 So. Racine Ave.	1893	Gray Iron & Semi-steel	Jobbing	25	A. W. Lemme	J. A. Ringman
Elliott Foundry & Machine Works 3335 So. Ridgeway Ave.	1906	Gray Iron & Semi-steel	Machinery	6	W. P. Elliott, Jr.	A. C. Abramson
Excel Pattern & Foundry Co. 2906 Carroll	1921	Brass, Bronze & Aluminum	Jobbing	3	P. J. Murphy	George Grasmeyer
Faith Mfg. Co. 5920-30 No. Crawford Ave.		Aluminum & Zinc-base Alloys	Die Castings			
Faunt Bros. Brass Foundry 1555 Fulton	1893	Brass & Bronze	Machinery	10	C. R. Faunt	H. W. Faunt
Fearon Foundry Co. 1420 W. Kinzie	1923	Gray Iron	Jobbing	15	Frank J. Fearon	Frank J. Fearon
Ferguson & Lange Foundry Co. 1039 Willow	1896	Gray Iron	Heavy, Medium & Light	60	H. O. Lange	L. Weckerley
Foot Bros. Gear & Machine Co. 111 No. Canal	1859	Steel & Gray Iron	Jobbing & Miscellaneous	20	J. F. Griswold	J. L. Whalen
Francis & Nygren Foundry Co. 2542 Fillmore	1898	Semisteel	Jobbing	25	Wm. Francis	Carl Nelson
General Brass Foundry 224 No. Ada	1915	Brass, Aluminum, Nickel & Bronze	Jobbing	¾	Frank Dazek	Peter Straka
Goodman Mfg. Co. Halsted St. & 48th Place	1900	Brass, Bronze & Aluminum	Coal Mine & Hydraulic Shovels	2	C. H. Strawbridge	C. H. Matts
Greenlee Foundry Co. 662 W. Roosevelt Rd.	1878	Semisteel & Gray Iron	Jobbing	30	C. B. Magrath	Peter Mate
Griffin Wheel Co. 445 No. Sacramento Blvd.	1870	Chilled Iron	Car Wheels	2500	F. L. Whitcomb	A. E. Domville
Hansell-Elcock Co. Archer & Normal Aves.	1888	Gray Iron, Steel & Nickel Alloys	Ornamental & General Jobbing	30–35	E. G. Elcock	F. Koepky
Hansen & Olsen Co. 506 So. Green	1909	Copper, Brass & Aluminum	Jobbing	10	Oscar Hansen	G. E. Olsen
Hanson Park Brass Foundry 2103 No. Major Ave.	1925	Brass, Bronze, Aluminum & Nickel	Jobbing	¾	John M. Micheles	Oscar Rahf
Arthur Harris & Co. 212 Curtis	1884	Brass & Bronze				
Hartnett Foundry Co. 2837 So. Halsted	1922	Aluminum, Brass & Bronze	Jobbing	3	B. E. Hartnett	J. Komstein
Herbert Boiler Co. Root & LaSalle	1879	Gray Iron & Semi-steel	Jobbing	5	Wm. H. Herbert	John Smith
Hills-McCanna Co. 2349 Nelson	1870	Bronze	Jobbing	2	A. H. Noyes	J. Schultz
Hodgson Foundry Co. 2014 W. 13th St.	1900	Brass, Bronze, Copper & Aluminum	Blast Furnace, Rolling Mill, Bridge & Jobbing		John W. Hodgson	John W. Hodgson
C. H. Hoppe Foundry Co. 373 W. Grand	1926	Gray Iron	Municipal	20	C. H. Hoppe	E. G. Fischer
Hubbard Portable Oven Co. 1134 Belden Ave.	1890	Gray Iron	Part of Industrial Plant	2½	J. W. Hicklin	T. Birn
Illinois Engineering Co. Racine Ave. at 21st St.	1905	Copper, Tin, Zinc & Monel	Heating Apparatus	1	Robert L. Gifford	Charles Reich
Illinois Malleable Iron Co. 1801 Diversey Blvd.	1880	Malleable, Gray Iron, Brass & Bronze	Jobbing & Railway		W. H. Burgess	Geo. Reeling
Illinois Steel Co. 208 So. LaSalle St.	1899	Gray Iron, Steel, Brass & Aluminum	Part of Industrial Plant			
Imperial Brass Mfg. Co. 1200 W. Harrison	1906	Brass, Aluminum, Bronze, Manganese Bronze	Nameplates, Jobbing, Automotive, Hardware & Gas Stove	12	Frank McNellis	W. L. Christensen
International Harvester Co. 1734 Fullerton Ave.	1888	Gray Iron	Agricultural	100–140		C. E. Casperson Peter Kwasinski
International Harvester Co. 2600 W. 31st St.	1903	Gray Iron	Agricultural & Tractor			
International Harvester Co. Blue Island & Western Ave.	1903	Malleable	Agricultural & Machinery			
Isagon Foundry 205 No. Clarkson Ct.	1926	Aluminum	Machinery & Electrical	¾	S. A. Whitehouse	S. A. Whitehouse
W. A. Jones Foundry & Machine Co. 4401 W. Roosevelt Rd.	1890	Gray Iron & Semisteel		40	W. G. Jones	W. C. Cureton
Kainer & Co. Inc. 761 W. Mather		Brass & Aluminum				
Kedzie Foundry Co. 3236 W. 31st St.	1914	Gray Iron, Semisteel & Alloy Irons	Jobbing, High Temperatures and Pressures	50	Gust Erlandson	John Strama
P. S. & J. E. Kelly 220 W. Ohio	1915	Brass, Aluminum & Alloys	General Jobbing	¾	P. S. Kelly	J. E. Kelly
Kelly Brass Works 226 W. Ontario	1904	Brass & Aluminum	General Jobbing, Part of Industrial Plant	5–6	F. W. Leuthesser Sr.	Wallace Kiney
Kensington Steel Co. 505 Kensington Ave.	1926	Manganese & Alloy Steels	Jobbing	8	Eugene C. Bauer Kenneth Jensen	Kenneth Jensen
W. W. Kimball Co. W. 26th & Marshall Blvd.	1857	Gray Iron	Piano Plates	7½	C. N. Kimball	A. A. Huseby
Kling Bros. Engineering Works 1300 No. Kostner Ave.	1917	Gray Iron & Semisteel	Jobbing & Machinery	20	Olaf E. Kling	Edward Ericson
Krone-Sebek Die Casting & Mfg. Co. 2935 W. 47th St.	1919	Aluminum & White Brass	Die Castings	20	Paul Krone	Albert Sebek
Leitelt Bros. 7731 So. Chicago Ave.	1913	Brass, Bronze & Aluminum	Jobbing	1	C. F. Leitelt	R. C. Brown
Henry Lindahl Foundry & Machine Co. 5900 Ogden Ave.	1880	Gray Iron & Semisteel	Jobbing & Machinery	6	Fred Lindahl	Harold Lindahl
Link-Belt Co. 300 W. Pershing Rd.	1909	Gray Iron & Steel	Part of Industrial Plant	20	W. C. Carter	Geo. O'Connor
Liquid Carbonic Corp. 3100 So. Kedzie Ave.	1888	Phosphor Bronze, Red & Yellow Brass	Soda Fountain Fittings	4¼	J. H. Pratt	F. J. Riley
Magnus Metal Co. Inc. 80 E. Jackson Blvd.		Brass & Aluminum				
Manufacturers Brass Foundry Co. Inc. 2727 Popular Ave.	1927	Brass, Bronze, Aluminum & Monel	Jobbing	2½	P. William	W. Hunter
McCarthy Foundry Co. Inc. 3307 So. Lawndale Ave.	1921	Gray Iron	Jobbing	20	W. F. McCarthy	W. J. Roe

Representative Foundries in Chicago

Name and Address	Established	Metal Melted	Class of Castings	Daily Output in Tons	President or General Mgr.	Foundry Supt.
Louis Meskan Brass Foundry, Inc. 2902 Carroll	1911	Brass, Bronze, Copper & Aluminum	Jobbing	5	Louis Meskan	Albert Meskan
A. Meskan Chandelier Foundry Co. 5119 W. Lake	1928	Brass, Bronze & Aluminum	Ornamental	½	Joe Meskan	A. Meskan
Mid City Foundry Corp. 945 W. 49th Place	1922	Gray Iron & Semi-steel	Jobbing	8	Lennart Dahlberg	Lennart Dahlberg
Midwest Brass Foundry 228 No. Washtenaw Ave.	1906	Brass, Bronze & Aluminum	Jobbing	1½	Joseph Szerlong	Joseph Szerlong
C. H. Milles Foundry Co. 2201 W. 35th St.	1911	Aluminum & Iron	Ornamental & Machinery	20	C. H. Milles	W. T. Milles
National Malleable & Steel Castings Co. 1400 South 52nd St.	1870	Malleable Iron, Steel & Alloys	Jobbing, Railway, Agricultural & Automobile	150	H. F. Pope J. O. Houze	B. C. Yearley
National Radiator Corp. Woodlawn Ave. & E. 83rd St.	1894	Gray Iron	Radiators & Boilers	50	J. H. Waters	W. K. Poland
Nichol-Straight Foundry Co. 3174 Archer Ave.	1904	High Test, Semisteel & Gray Iron	Pressure & Machinery	18	D. N. Gellert	John H. Gellert
Noonan-Malmstrom Co. 2135 Carroll Ave.	1928	Gray Iron & Semi-steel	General Jobbing	7–10	L. R. Noonan	W. K. Malmstrom
Notrhwestern Foundry Co. 731 Bunker	1912	Gray Iron	Jobbing	20	C. B. Magrath	E. M. Blonien
The Orme Co. 643 Railway Exchange Bldg.	1922	Brass, Bronze	Railway	20	T. D. Hogan Jr.	
Pettibone Mulliken Co. 4710 W. Division St.	1880	Gray Iron, Alloy & Carbon Steels	Jobbing, Railway & Agricultural	50	C. H. Eih	G. W. Merrefield
Pullman Car & Mfg. Co. Pullman Bldg.		Chilled Iron	Car Wheels	220	C. A. Liddle	J. J. Trant
Pyle-National Co. 1334 North Kostner Ave.	1898	Iron, Brass & Aluminum	Railway & Locomotive Head Lights	6½	L. H. Vilas	A. G. Koepke
Pyott Foundry Co. 328 No. Sangamon	1897	Gray Iron	Sheaves, Gear Blanks, Jobbing, Laundry Machinery	25-30	M. F. Dunne	H. W. Kelly
Rauen Foundry Co. 4645 W. 58th St.	1928	Brass, Bronze, Copper & Aluminum	Jobbing	½	Francis J. Rauen	
Ravenswood Brass Foundry Co. 3159 Elston Ave.	1915	Brass, Bronze & Aluminum	Jobbing	1	E. H. Kortum	
Reder Foundry Co. 3535 Oakley Ave.	1881	Gray Iron	Jobbing			
Riverside Iron Works 10640 Buffalo Ave.	1905	Iron & Semisteel	Jobbing	30	R. Kaufmann	W. G. Slaney
Robey Foundry Co. 5817 Damen Ave.	1923	Gray Iron	Jobbing	1	M. Prachek	E. Ganser
Roos Foundries, Inc. 1749 No. Ballon	1920	Gray Iron	Machinery	18	J. P. Hansen	E. Eul
J. J. Ryan & Co. 104 So. Jefferson	1882	Copper, Brass & Aluminum	Jobbing & Plumbing Supplies	3	J. J. Ryan	S. McGarrigle
Semi-Steel Test Foundry Co. 4916 Bloomingdale Ave.	1910	Semisteel & Gray Iron	Jobbing	30	George Wolf	Richard Peterson
Sheffield Foundry Co. 2021 Herndon	1902	Gray Iron & Semisteel	General Jobbing	15	H. F. Lehmpuhl	A. F. Zitzewitz
Sivyer Steel Casting Co. 3100 So. Wood	1903	Carbon & Alloy Steels	Jobbing	40	L. S. Peregoy	C. St. Clair
Sloan Valve Co. 4300 W. Lake	1906	Brass & Nickel	Valve Castings	10¼	W. E. Sloan	W. B. George
Smeeth Harwood Co. 2401-2409 W. 22nd St.	1855	Copper	Blast Furnace	3–30	H. E. Smeeth	W. E. Warner
Stewart Die Casting Corp. 4535 Fullerton Ave.	1913	Aluminum, Tin, Zinc & Lead	Die Castings	150	L. H. La Chance	Eric Carlson
Stewart-Nelson Co. 464 West 33rd St.	1930	Brass, Bronze & Aluminum	Jobbing	4	W. K. Nelson	A. O. Stewart
Street & Kent Mfg. Co. 1956 Clybourne	1888	Brass	Plumbers Brass Goods	4	W. J. Street	R. P. Kent
J. Streic & Co. 2412 S. Kostner	1923	Brass & Bronze	Jobbing	¼	J. Streic	J. Streic
Tarrant Foundry Co. 1338 Cortland	1885	Gray Iron & Semisteel	Heavy Jobbing	50	W. J. Michel	J. Johnson, Sr.
Thompson-Neaylon Mfg. Co. 3545 So. Morgan	1921	Brass	Battery Terminals	2	T. T. Thompson	Geo. Jambor
Troy Brass & Aluminum Foundry Rockwell & 21st St.	1925	Brass, Bronze & Aluminum	Jobbing	7½	J. L. Spalke	Ben Chelini
Universal Brass Foundry 616 W. Kinzie	1918	Brass, Bronze, Aluminum & German Silver	Jobbing	2½	J. Norwell	J. Norwell, Jr.
Vierling Steel Works 23rd & Stewart Ave.	1881	Gray Iron	Jobbing	15	D. T. Molthop	J. G. Pankratz
Vulcan Iron Works 327 No. Irving Ave.	1852	Gray Iron	Machinery	5		
Weidenmiller Bros. Inc. 5315 Ravenswood Ave.	1925	Brass, Bronze Aluminum & Nickel Silver	Jobbing	1	E. A. Weidenmiller	E. A. Weidenmiller E. O. Weidenmiller
Western Electric Co. 48th Ave. & 22nd St.	1904	Iron, Brass, Bronze & Aluminum	Jobbing		E. S. Bloom	W. P. Randall
Western Foundry Co. 3634 So. Kedzie Ave.	1892	Gray Iron & Aluminum	Jobbing	100	J. P. O'Neil	H. T. Odenkirk
Wolff Co. 2057 Fulton	1855	Gray Iron & Brass	Plumbing Goods			
Youngstown Sheet & Tube Co. South Chicago		Gray Iron & Brass	Part of Industrial Plant			
Zimmerman Bros. & Co. 4020 South Michigan Ave.	1930	Bronze, Brass & Aluminum	Jobbing	1	Joseph Fabian	Pat Davaney

A. F. A. Offers Valuable Technical Program

(*Concluded from Page* 113)

again have on display the patterns and castings made in the local apprentice contests, which have been held throughout the country. First, second, and third prizes will be given to the best entries in each of three groups; namely, pattern making, gray iron molding and steel molding. Plants and groups which will have material in the contests are as follows:

American Car & Foundry Co., St. Louis; American Manganese Steel Co., Chicago Heights, Ill.; Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; Brown & Sharpe Mfg. Co., Providence, R. I.; General Electric Co., Schenectady, N. Y.; Miehle Printing Press & Mfg. Co., Chicago; Reading Steel Casting Co., Reading, Pa.; Rockford Standard Pattern Works, Rockford, Ill.; East Chicago District Foundries, East Chicago, Ind.; Milwaukee Branch, National Metal Trades association, Milwaukee; Tri-City Manufacturers' association, Moline, Ill.

The committee on foundry sand research will have on display a working exhibit showing equipment and apparatus which has been developed for the testing and control of foundry sands. Practically all the equipment described in the 1930 edition of "Testing and Grading Foundry Sands," as issued by the committee, will be shown. Attendants will be on hand to supply information.

Chicago Skyline at Night with Buckingham Fountain in the Foreground

Display Plan Provides Greater Facilities

WHILE business in general has been dipping to the lowest point in recent years and then starting the slow but steady climb to perhaps even greater heights, manufacturers of foundry equipment have been expending time and energy in developing new equipment and improving machines which already have been of great service to the foundry industry. Results of the past year's experimental work, in many instances, will be shown for the first time at the exhibition of foundry equipment and supplies, which will be held in the Stevens hotel, May 4 to 7, in conjunction with the annual convention of the American Foundrymen's association.

Many members of the A. F. A. will remember the exceptionally valuable show which was held in the exhibition hall of the Stevens in 1929. While the 1930 exhibit will be patterned after the previous display, additional floor space has been provided in the ball room of the hotel, so that a wider variety of equipment and supplies may be shown. In addition to the commercial displays, exhibits will be maintained by the Gray Iron institute, the American Society of Mechanical Engineers, the American Standards association and the National Founders association. A. F. A. committees will also have displays.

For the benefit of those desiring more information regarding to the exhibits, The Foundry has prepared the following detailed descriptions of the individual displays and the lists of the company representatives who will attend the Chicago convention and exhibition.

A

ABRASIVE CO., Philadelphia—An assortment of foundry grinding wheels for grinding cast iron and steel will be displayed. Both bakelite and vitrified wheels for regular and high speed equipment will be shown. The following men will represent the company: A. Dobson, W. E. Byrne and G. W. Collman.

Abrasive Industry, Cleveland—This booth will be equipped as a lounge for the entertainment of visitors and the display of business publications and technical books. The representatives will be Dan M. Avey, J. M. Lathrop and J. W. Close.

ADAMS CO., Dubuque, Iowa—This display will include jolt squeeze molding machines, snap flasks, slip flasks, steel jackets and speed reduction units. The company will be represented by William J. Spensley, John A. Cameron, Lester A. Demkier, John B. Meyer, Harlow Adams and Philip Adams.

ADVANCE MILLING CO., Chicago—Samples of the core binder that this company manufactures will feature this exhibit.

AIR REDUCTION SALES CO., New York—The exhibit of this company will feature tanks of oxygen and acetylene, carbide and apparatus for oxyacetylene welding and cutting.

AJAX ELECTRIC FURNACE CORP., Philadelphia—This display will feature a sectional model of the type of electric furnace manufactured by this company and a model of a 1-ton mechanical nose tilting electric furnace. Henry Gieseke will be in charge.

AJAX ELECTROTHERMIC CORP., Trenton, N. J.—Two high frequency induction furnaces, one of 1000 pounds capacity and the other a 17-pound capacity laboratory furnace, will be exhibited. Views of typical installations of furnaces for the production of stainless and tool steels also will be shown. The display will include various types of stainless steel castings made from metal melted in those type furnaces. G. H. Clamer, Dudley Willcox, R. N. Blakeslee and A. Dean Meyer will represent the company.

AJAX METAL CO., Philadelphia—Brass and bronze ingots of all kinds and various types of castings made from these metals will be shown by the company.

ALBANY SAND & SUPPLY CO., Albany, N. Y.—Samples of the foundry sands produced by this company will feature this exhibit.

AMERICAN BRAKE SHOE & FOUNDRY CO., Chicago—The booth of this company will be fitted out as a rest room for visitors. Representatives will be: V. G. Bates, J. F. Quinn and C. P. Wright.

AMERICAN FOUNDRY EQUIPMENT CO., Mishawaka, Ind.—A new type combination tumbling and sand blast cleaner with a blasting chamber 30 x 30 inches, will be displayed. J. S. Sammons, O. A. Pfaff, H. H. Haley, J. D Alexander, C. D. Steinmeier, C. L. Benham, James Rigby, Jerome E. Sweet, C. B. Schneible, F. G. Schultz, E. J. Turnbull, A. H. Freeman, Charles Rose, Dave Logan, and V. E. Minich will attend.

APEX SMELTING CO., Chicago—This company will show aluminum and its alloys, castings made from those metals

and an aluminum flux for foundries.

ARCADE MFG. CO., Freeport, Ill.—This company will exhibit various types of molding and coremaking machines, steel flasks and wooden snap flasks. L. L. Munn, B. C. Trueblood, Mentor Wheat, V. S. Firestone, August Christen, Herman Kasten, R. E. Turnbull and Maurice Brown will be in attendance.

ARMSTRONG BLUM MFG. CO., Chicago—The display of this company will feature machinery for the removal of gates and risers.

AUSTIN CO., Cleveland—Layouts, design drawings and specifications, and photographs of modern production and jobbing foundries for casting gray iron steel, malleable and nonferrous metals, will be shown. Photographs will show the foundry of the Caterpillar Tractor Co., Peoria, Ill. The company will be represented by Albert S. Low, Harry E. Eiber, Ralph Leavenworth and N. L. Palmer.

AUTOMATIC TRANSPORTATION CO., INC., Buffalo—Models of spur gear drive industrial trucks, tractors and cranes for the handling of raw materials, semifinished, and completed castings will be exhibited. L. R. Lindsley and W. F. Weber will be the representatives of the company.

B

C. O. BARTLETT & SNOW CO., Cleveland—The exhibit of this company will consist of parts and photographs of sand handling and mold conveying equipment. H. S. Hersey, H. L. McKinnon, M. E. First, H. C. Orr, W. J. Freuchtel, Oliver S. Kelly and S. G. Artingstalf Jr. will be in charge of the booth.

H. L. BAUMGARDNER MFG. CO., Fremont, O.—Aluminum flasks, magnesium flasks and cast iron jackets will be exhibited by this company.

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y.—Apparatus for the microscopic examination of metals will be displayed.

BEARDSLEY & PIPER CO., Chicago—Talking moving pictures taken at various plants in which the products of this company are installed, will be shown. The pictures will feature the sand mixing machine and vibrating shake-out which recently were placed on the market by this company. E. O. Beardsley, W. F. Piper, E. O'Connor, W. E. Naylor, N. W. Stratford, A. V. Magnuson, George Furman, H. G. Schlichter, E. L. Mitchell, H. Lind, A. L. Miller, P. Stefan, and R. Snow will represent the company.

BETHLEHEM STEEL CO., Bethlehem, Pa.—This exhibit will show various types of pig iron manufactured for the foundry industry by this company.

BLACK & DECKER MFG. CO., Towson, Md.—Portable electric tools will be shown in this booth. The company will be represented by Curtis Watts, H. B. Mecaslin, G. J. Coffey, W. J. Fenwick, John Schreiner, George W. Stoiber and A. M. York.

BLAW-KNOX CO., Pittsburgh—A hookon type, single line, clamshell bucket will be featured in the booth of this company. The exhibit will be in charge of William W. Cochrane and Gus Schirmer.

BRADLEY WASHFOUNTAIN CO., Milwaukee—The display of this company will feature wash room equipment.

BRITISH ALUMINUM CO., LTD., New York—Virgin aluminum ingots, aluminum alloy ingots and castings made from those alloys will be exhibited. The following representatives of the company will be in attendance: Arthur Seligman, Arthur Jellinek and A. J. Field.

C

CAMPBELL-HAUSFELD CO., Harrison, O.—This company will display gas and oil-fired melting furnaces for nonferrous alloys. The company will be represented by E. B. Hausfeld and J. S. Armour.

CARBORUNDUM CO., Niagara Falls, N. Y.—A general display of abrasive products used in the foundry industry will be featured at the booth of this company. S. F. Courter, F. E. Gridley, R. C. Bradbury, R. Rainnie, L. E. Ells, G. W. Chormann and B. H. Work will be at the booth

CARBORUNDUM CO., Refractories division, Perth Amboy, N. J.—Various types of refractories including brick, tile, special shapes and high temperature refractory cements will be shown, together with photographs of installations

Exhibit Will Be Located in the

A

Abrasive Co. 74
Abrasive Industry 210, 212
Adams Co. 116
Advance Milling Co. 37
Air Reduction Sales Co. 262, 264
Ajax Electric Furnace Co. 124
Ajax Electrothermic Corp. 122
Ajax Metal Co. 126
Albany Sand & Supply Co. 68
American Brake Shoe & Foundry Co. 18
American Foundry Equipment Co. 106, 123
American Society of Mechanical Engineers 269
American Standards Association 271
Apex Smelting Co. 35
Arcade Mfg. Co. 112
Armstrong Blum Mfg. Co. 129
Austin Co. 134
Automatic Transportation Co. 82

B

C. O. Bartlett & Snow Co. 77, 79
H. L. Baumgardner Mfg. Corp. 49
Bausch & Lomb Optical Co. 250
Beardsley & Piper Co. 1, 2, 3, 4
Bethlehem Steel Co. 86
Black & Decker Mfg. Co. 62
Blaw-Knox Co. 20
Bradley Washfountain Co. 33
British Aluminum Co., Ltd. 228

C

Campbell-Hausfield Co. 91
Carborundum Co. 94
Carborundum Co., Refractory Div. 96, 98
Chain Belt Co. 32, 34
Chicago Mfg. & Distributing Co. 256
Chisholm-Moore Hoist Corp. 19
Clark Tructractor Co. 61, 63
Clearfield Machine Co. 55
Clipper Belt Lacer Co. 101
Corn Products Refining Co. 43

D

Wm. Demmler & Bros 52
Detroit Electric Furnace Co. 135
H. W. Dietert Co. 104
Joseph Dixon Crucible Co. 88

E

Electric Storage Battery Co. 279
Electro Alloys, Inc. 238
Electro-Chemical Pattern & Mfg. Co. 239
Electro Refractories Corp. 251
Euclid Crane & Hoist Co. 17

F

Fort Pitt Steel Casting Co. 30
The Foundry 210, 212
Foundry Equipment Co. 58
Foundry Supplies Mfg. Co. 266

G

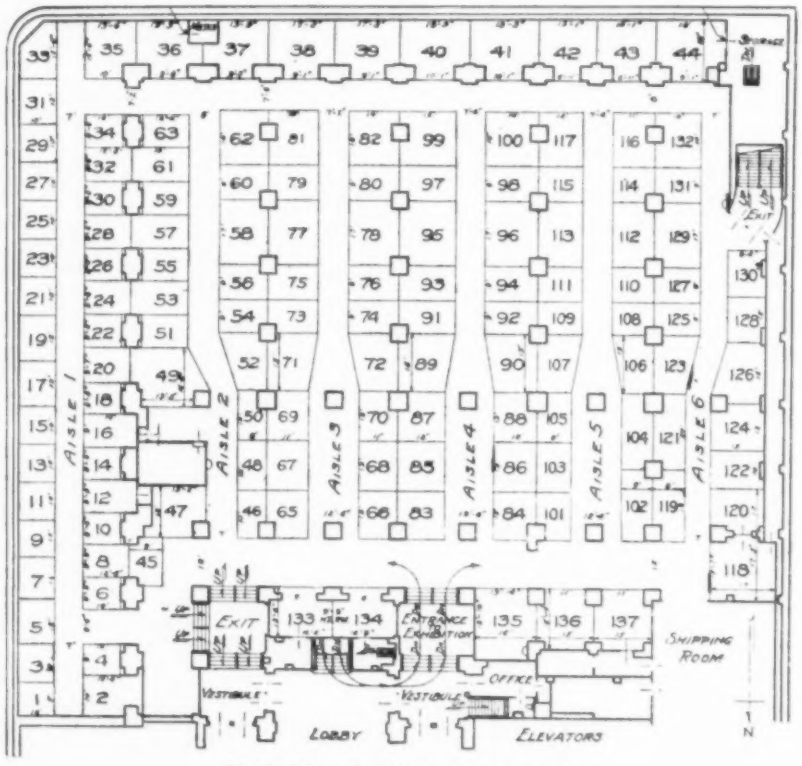
Galland-Henning Mfg. Co. 26
General Electric Co. 108, 110, 125, 127
General Electric X-Ray Corp. 216
Globe Steel Abrasive Co. 24
Claud S. Gordon Co. 234
Gray Iron Institute 267
Great Lakes Foundry Sand Co. 83
Great Western Mfg. Co. 132
Griffin Engineering Co. 260
Grindle Fuel Equipment Co. 120

H

Harnischfeger Sales Corp. 15
Herman Pneumatic Machine Co. 40
Heston & Anderson 114
Edward Hines Lumber Co. 277

I

Illinois Clay Products Co. 240
Illinois Testing Laboratories 215
Industrial Minerals Co. 209
International Molding Machine Co. 89
International Nickel Co., Inc. 213



Exhibition Hall in Stevens Hotel

of a recuperator manufactured by the company and models showing cross-sectional views of brick and cement used in nonferrous melting furnaces. R. A. Beverley, R. J. Penny, R. S. Baker and A. I. Jacobs will be in attendance.

CHAIN BELT CO., Milwaukee—Samples of leak-proof, apron conveyors for handling shakeout sand and castings, an aerator for sand conditioning, motion pictures of continuous molding units in operation and photographs of installations of various types of equipment manufactured by the company will be included in this exhibit. The company will be represented by J. C. Merwin, W. B. Marshall, F. A. Pampel, G. K. Viall, E. M. Handley, F. S. Bosworth, R. X. Raymond and A. J. Bell.

CHICAGO MFG. & DISTRIBUTING CO., Chicago—Foundry specialties including a pneumatic core transport, bag holder truck, chipping hammers, flasks and bottom boards, skimmer heads and a line of pattern work will be featured. Mr. Scheffler and E. M. Leigh will be in charge.

CHISHOLM-MOORE HOIST CORP., Tonawanda, N. Y.—A ball bearing, spur-geared, high-speed, chain hoist equipped with antifriction bearings at rotating points; a standard, totally enclosed, screw hoist equipped with a steel worm and bronze gear; a roller bearing trolley designed for severe service and adaptable to monorail tracks; a ball bearing trolley of 1 and 2-ton capacities adjustable to I-beams up to and including 20-inch; an electric chain hoist equipped with antifriction bearings at rotating points, single speed operation, ball bearing motor with magnetic clutch and pendant rope or push button control; and a light weight, aluminum, high-speed, spur-geared, chain hoist designed for installations where head room is limited, will be exhibited. D. S. Brisbin, F. W. Shaw, F. E. Stahl, W. K. Robbins, H. N. Hayes and C. E. Miller will represent the company.

CLARK TRUCTRACTOR CO., Battle Creek, Mich.—Photographs and data on the adaptability of the equipment made by this company to foundry material handling conditions will be exhibited.

CLEARFIELD MACHINE CO., Clearfield, Pa.—A laboratory size sand mixing machine will be exhibited at the booth of this company. Representatives will include F. B. Reed, W. E. McMurray, Ross Quigley and P. B. Reed.

CLIPPER BELT LACER CO, Grand Rapids, Mich.—Various models of belt lacers, belt fasteners, connecting pins and belt cutters with safety features will be shown.

CORN PRODUCTS REFINING CO., New York—This company will show a line of cereal core binders and cores made from its products.

D

WM. DEMMLER & BROS., Kewanee, Ill.—A core blowing machine equipped with sand elevator and feeding device will be shown by this company. Representatives will include H. L. Demmler, F. A. Demmler and J. N. Demmler.

DETROIT ELECTRIC FURNACE CO., Detroit—This company will show a 500-pound capacity, rocking type, electric furnace and brass, bronze, gray iron, malleable and alloy steel castings made from metal melted in electric furnaces manufactured by the company. This company will be represented by E. L. Crosby, A. E. Rhoads, C. H. Morken, L. C. Wilson and L. T. Crosby.

HARRY W. DIETERT CO., Detroit—A line of molding sand, core sand and mold testing equipment meeting American Foundrymen's association specifications will be exhibited at this booth. Equipment includes apparatus used for tempering sand, and for testing moisture, permeability, strength, core permeability, core strength, fusion point, clay bond, core binding, and mold hardness. H. W. Dietert, Frank Valtier, Herman Cooper, and Charles Seman will be in attendance.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.—Various products made by this company will be featured at the exhibit.

E

ELECTRIC STORAGE BATTERY CO., Philadelphia—Storage batteries for electric trucks, tractors and locomotives will be shown.

ELECTRO ALLOYS INC., Buffalo—Copper,

Exhibition Hall and Ball Room

J

Johnston & Jennings Co. 107

K

Chas. C. Kawin Co. 109
Spencer Kellogg & Sons Sales Corp.... 41
Kelly Graphite Mills, Inc. 14
Kelley-Koett Mfg. Co., Inc. 231
Kling Bros. Engineering Works..... 130
Knefler-Bates Co. 56
H. Kramer & Co. 16
John Kramer Alloy Corp. 243
Chas. A. Krause Milling Co. 12

L

Laclede-Christy Clay Products Co..... 102
E. Leitz, Inc. 261
Lindsay-McMillan Co. 66
Link-Belt Co. 38
Louden Machinery Co. 226
R. Labin & Sons..... 243

M

McCloud River Lumber Co. 47
McCollum Hoist & Mfg. Co. 28
R. W. McIlvaine Co. 229
Machine Design 210, 212
Macleod Co. 22
Paul Maehler Co. 121
Mathews Conveyor Co. 42
Mechanite Research Institute 258
Michigan Smelting & Refining Co. 100
Milwaukee Foundry Equipment Co..... —
Moline Iron Works ..... —
Moltrup Steel Products Co. 48
Monarch Engineering & Mfg. Co. 54

N

National Engineering Co. 95
National Founders' Association 255
National Smelting Co. 6
New Haven Sand Blast Co. 225
Newaygo Engineering Co. 32
Niagara Concrete Mixer Co. 204
Niagara Falls Smelting & Refining Co. 214
Wm. H. Nicholls Co., Inc. 97, 99
Northern Engineering Works 13
Norton Co. 23-25

O

S. Obermayer Co. 92
Oliver Machinery Co. 71
Osborn Mfg. Co. 128

P

Pangborn Corp. 76, 78
Parsons Engineering Corp. 36
Penton Publishing Co. 210, 212
Pickands, Brown & Co. 137
Pittsburgh Electric Furnace Corp..... 133
Productive Equipment Corp. 131
Pyrometer Instrument Co. 278

R

Royer Foundry & Machine Co.....
..... 113, 115, 117

S

Safety First Shoe Co. 227
Safety Grinding Wheel & Machine Co. 103
St. Louis Gas & Coke Corp. 60
Sand Products Corp. 202
Schoelkopf Mfg. Co. 270
Semet-Solvay Co. 201
Shepard Niles Crane & Hoist Corp.....5, 7
W. W. Sly Mfg. Co. 90
Werner G. Smith Co. 39
Smith Oil & Refining Co. 119
Spencer Turbine Co. 80
Standard Conveyor Co. 235
Standard Safety Equipment Co. 206
Standard Sand & Machine Co. 93
Standard Silica Co. 209
Steel 210, 212
Steelblast Abrasive Co. 36
Sterling Wheelbarrow Co. 72
Stone Pattern Mount Co., Inc. 31
Superior Charcoal Iron Co. 233
Superior Flake Graphite Co. 208
Swan-Finch Oil Corp. 27

T

Tabor Mfg. Co. 73, 75
Truscon Steel Co. 242
W. S. Tyler Co. 29

U

United Compound Co. 59
Universal Sand Equipment Co. 51, 53
U. S. Reduction Co. 67

V

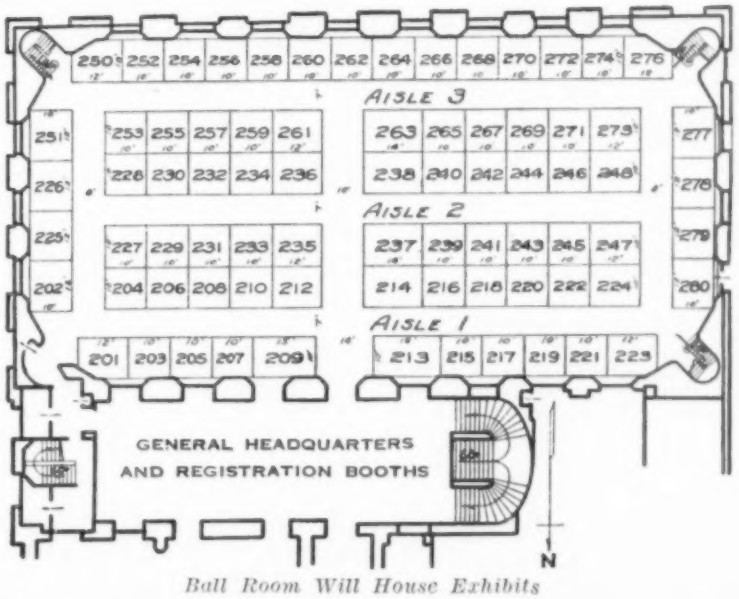
Vesuvius Crucible Co. .....

W

White Rock Silica Co. 237
Whiting Corp. 118, 120
Wright Mfg. Co. 81

Z

Zanesville Sand Co. 46



Ball Room Will House Exhibits

nickel and aluminum alloys will be exhibited by this company. L. V. Milward, George Michie, D. B. Milward and T. W. Campbell will represent the company.

ELECTRO-CHEMICAL PATTERN & MFG. CO., Detroit — Copper metal pattern equipment including cope and drag plates, split patterns and mounted split patterns will be shown. The company will be represented by A. K. Laukel, J. H. Laukel, A. M. Sargent and S. Reed

ELECTRO REFRACTORIES CORP., Buffalo—Crucibles, patch cement and silicon carbide refractories will be displayed. The following men will be in attendance: L. U. Milward, D. B. Milward and T. W. Campbell.

EUCLID CRANE & HOIST CO., Euclid, O. —Several types of electric hoists with various methods of control, together with photographs of installations will be featured by this company. Representatives will be H. H. Kumler and R. W. Young.

F

FORT PITT STEEL CASTING CO., McKeesport, Pa.—

THE FOUNDRY, Cleveland—This booth will be equipped for the entertainment of visitors and the display of business publications and technical books. The representatives will be Dan M. Avey, Frank G. Steinebach, Patrick Dwyer, Edwin Bremer, F. B. Pletcher, J. D. Pease, J. M. Lathrop, C. A. Wardley, and J. W. Close.

FOUNDRY EQUIPMENT CO., Cleveland—An oven equipped with insulated steel panel housings and photographs of typical installations of ovens will be featured at this booth. Representatives will be: C. A. Barnett, C. F. Mayer, O. D. Conover, M. A. Beltaire, E. J. Welter and F. T. Turner.

FOUNDRY SUPPLIES MFG. CO., Chicago—Electric vibrators and other equipment will be displayed.

G

GALLAND-HENNING MFG. CO., Milwaukee—Valves for air, gas, water, oil and other materials will be featured at this booth.

GENERAL ELECTRIC CO., Schenectady, N. Y.—This company will exhibit welding equipment, motors and control equipment, and cupola blowing equipment.

GENERAL ELECTRIC X-RAY CORP., Chicago—This company will feature a collection of x-ray radiographs showing various types of imperfections in castings and the results obtained from changes in foundry practice. Other radiographs will show methods of determining strain in materials and the effects of heat treatment. E. W. Page, R. Dent, S. Nilson, E. O'Donnell and C. Wantz will be at the booth.

GLOBE STEEL ABRASIVE CO., Mansfield, O.—Samples of shot for cleaning room operations will be featured at this booth. C. H. McConnell will be in charge.

CLAUD S. GORDON, Chicago—Service of the new commercial x-ray laboratory that this company recently established will be stressed.

GREAT LAKES FOUNDRY SAND CO., Detroit—Refractory and rebonding clays; bentonite; molding, core and bank sands; sand blast sand; coke and nozzles will be features of this exhibition. The company will be represented by William J. Muhlitner, John D. Cronenweth, Neil I. McArthur, James G. Mendenhall, Mason B. Giberson Sr., Earl L. Smitherman, Henry M. Lane, H. P. MacKinnon, and Phil E. Giberson.

GREAT WESTERN MFG. CO., Leavenworth, Kans.—Several types of electrically driven gyratory riddles and sifters will be exhibited at this booth. J. E. Baker will be in charge of the booth.

GRIFFIN ENGINEERING CO., Chicago—The display of this company will include blue prints, charts and photographs of typical installations of an apparatus used to preheat the ingoing blast to cupolas. The booth will be in charge of J. W. Hurley and J. J. Boland.

GRINDLE FUEL EQUIPMENT CO., Harvey, Ill.—A direct firing pulverizer including feeder and pulverized coal burner will be exhibited by this company. The company will be represented by W. R. Bean, M. F. Becker, C. R. Taylor, R. J. Bender, A. F. Uelman and E. H. Nielsen.

H

HARNISCHFEGER SALES CORP., Milwaukee—This company will show two electric hoists, one equipped with push button control and the other for variable speed operation. Walter Harnischfeger, G. L. Drake, N. B. Patterson, N. P. Farrar, F. A. Liebich, P. E. Anderson, B. Van Horn, W. Peters, A. Jenss, C. L. Meyer, H. S. Strouse and L. M. Palmer will represent the company.

HERMAN PNEUMATIC MACHINE CO., Zelienople, Pa.—High speed, jar, roll-over molding machines and automatic fluid timing valves will be displayed. Thomas Kaveny, Thomas Kaveny Jr., Robert Kaveny, R. Harris, R. F. Ringle, T. A. Renkenberger, I. J. Oesterling, L. D. Plassmeyer, Alfred Herman, R. P.

The Old Water Tower Is a Landmark

Morgan, C. W. Miller, C. S McMath, W. W. Hughes, R. M. Porteous, L. L. Johnston and Joseph W. Gibson, will be in attendance.

HESTON & ANDERSON, Fairfield, Iowa—This company will feature a line of motor driven, woodworking machinery for pattern shops. J. D. Parrett and F. R. Heston will be in charge of the display.

EDWARD HINES LUMBER CO., Chicago—Pattern lumber will be displayed.

I

ILLINOIS CLAY PRODUCTS CO., Joliet, Ill. —Fire clay and fire clay flour suitable for bonding and rebonding purposes will be shown. O. L. Jones and A. S. Nichols will be in attendance.

ILLINOIS TESTING LABORATORIES INC., Chicago—This company will display portable and stationary pyrometers and accessories for various uses including those used for nonferrous metals, annealing furnaces, core ovens, heat treating and general use. The booth will be in charge of M. R. Pugh and J. A. Obermaier.

INDUSTRIAL MINERALS CO., Columbus, O.—Molding, core and blast sands will be displayed by this company. The booth will be in charge of W. G. Edwards and H. N. Rose.

INTERNATIONAL MOLDING MACHINE CO., Chicago—The exhibit of this company will include various designs of molding and coremaking machines. The company will be represented by Edward A. Pridmore, Harold E. Pridmore, Lawrence V. Pridmore, W. W. Miller, E. G. Borgnis, Hugh Gallagher, M. J. Monahan, W. J. Rowley, Luke S. Shannon, J. C. Kingsland, William L. Garner, W. J. Briggs, Carl Levahn and Clarence Becklin.

INTERNATIONAL NICKEL CO. INC., New York—Typical applications of nickel and nickel-bearing foundry products will be exhibited. Members of the development and research department will be in attendance to discuss problems involving the application of that alloy. T. H. Wickenden, F. B. Coyle, J. S. Vanick, A. L. Zima, T. H. Kilghren, H. Larsen and E. J. Bothwell will represent the company.

J

JOHNSTON & JENNINGS CO., Cleveland —A large jolt rollover, pattern draw molding machine together with drawings and photographs of the line of equipment made by this company will feature this display. J. L. Battenfeld, R. W. Bramling and T. J. Calhoun will be in attendance.

K

CHAS. C. KAWIN CO., Chicago—This company will distribute information regarding its foundry advisory service and analysis work.

SPENCER KELLOGG & SONS SALES CORP., Buffalo—This company will display linseed base core oils and cores made with those binders. H. A. Swales, J. N. Yaeger, E. G. Allen, E. A. Medbery, E. E. Sutehall and W. L. Goetz will be at the booth.

KELLEY GRAPHITE MILLS INC., Stockertown, Pa.—This company will display various types of foundry facings.

KELLEY-KOETT MFG. CO. INC., Covington, Ky.—Films, illuminators and x-ray diffraction and radiographic equipment will be featured by this company.

KLING BROS. ENGINEERING WORKS, Chicago—High speed, heavy duty grinders will be featured by this company. Representatives will include R. E. Kling, H. J. Aagaard and W. Clegg.

KNEFLER-BATES CO., Indianapolis—Cereal core binders and facing flours made by the company will be displayed. The company will be represented by George B. Hill, John A. Green and Herbert J. Bever.

H. KRAMER & CO., Chicago—The display of this company will feature brass and bronze ingots for nonferrous foundries. The display will be in charge of I. Kadden, L. Chapman, W. Romanoff, C. O. Thieme, S. M. Marks, N. F. Kepner, F. F. Heymann, W. C. Yenger, A. S. Danziger, B. P. Cooke and J. H. Burns.

CHAS. A. KRAUSE MILLING CO., Milwaukee—This company will exhibit cereal core binders and sample cores made from them. H. D. Farris, Guy E. Lund, B. Y. Leslie, S. H Werner and H A. Whiting will be at the booth.

L

LACLEDE-CHRISTY CLAY PRODUCTS CO., St. Louis—An exhibit of special refractories applicable to gray iron, brass, malleable and steel foundries such as sleeves and nozzles, special ladle linings, electric furnace linings, special refractories, etc., will be featured. The company will be represented by J. H. McKelvey, A. W. Buckingham, E. G. Kiefer and J. L. Cummings.

E. LEITZ INC., New York—This company will display apparatus for the microscopic examination of metals.

LINDSAY-MCMILLAN CO., Milwaukee—This exhibit will feature core oils and a mold wash. In addition, cores showing the use of the core oil and mold wash in

steel, gray iron, malleable and nonferrous foundries will be shown. Representatives of the company will include W. R. Pate, J. A. Gitzen, R. G. Walker, M. A. Pollard, G. L. Buckley and R. C. Hardie.

LINK-BELT CO., Chicago—A vibrating shake-out riddle, a revivifier for molding sand, a section of an apron conveyor, and several type positive drives including speed reducers will be exhibited. A talking robot will greet visitors at the booth. The company will be represented by W. C. Carter, E. J. Burnell, W. L. Burnell, W. L. Hartley, J. J. Hartley, H. L. Hoefman, R. J. Heisserman, and Norman Smith

LOUDEN MACHINERY CO, Fairfield, Iowa—Monorail equipment including track and trolleys will be displayed. L. F. Berthold, A. Neher and John A. Burtchaell will represent the company.

Mc

MCCLOUD RIVER LUMBER CO., San Francisco—Specimen boards of various commercial grades of sugar pine pattern lumber will be featured at this booth. Emanuel Fritz will be in charge.

MCCULLOM HOIST CO., Downers Grove, Ill.—Hoists of various types for foundry use will be exhibited by this company.

R. W. MCILVAINE CO., Chicago—This company will show photographs of sand and mold handling systems and cupola charging apparatus as well as a portable instrument for determining the moisture in molding sand.

M

Machine Design, Cleveland — This booth will be equipped as a lounge for the entertainment of visitors and the display of business publications and technical books. The representatives will be F. H. Johnson, E. L. Shaner and H. H. Dreyer.

PAUL MAEHLER CO., Chicago—This company will show core baking equipment.

MATHEWS CONVEYOR CO., Elwood City, Pa.—An exhibit demonstrating the operation of conveyor rollers under severe service conditions, sample rollers from one to four inches in diameter, sections of rollers, and a section of a heavy duty conveyor will be shown. The following men will be in attendance at the exhibit. F. E. Moore, W. L. Dean, Charles A. Adams, M. J. Anderson, Jason Smith, A. M. Wright, Lee Sekulski, Fred F. Stoll, H. Cucullu, A. B. Evans, C. P. Kumler and Folmar Bjerre.

MICHIGAN SMELTING & REFINING CO., Detroit—Various types of brass and bronze ingot, aluminum ingot of various types, babbitt metals, etc., will be shown at this exhibit.

MILWAUKEE FOUNDRY EQUIPMENT CO., Milwaukee — Photographs of installations and drawings of various type molding machines will be featured at the booth of this company.

MOLTRUP STEEL PRODUCTS CO., Beaver Falls, Pa.—This company will exhibit pattern plates, core plates, bottom plates, cold drawn steel, keys and racks. Those in charge of the booth will include J. M. Lithgow, F. F. Ward and L. B. Lesh.

MONARCH ENGINEERING & MFG. CO., Baltimore—Several sample furnaces will be on display at this booth. James V. Martin, Harold L. Harvey and W. H. Raber will be in attendance.

N

NATIONAL ENGINEERING CO., Chicago—The exhibit of this company will include a sand-mixing machine equipped at the discharge with a sand aerating mechanism. Views of sand preparing, sand handling and molding equipment, blue prints and other data will be exhibited. The following men will represent the company: H. S. Simpson, A. G. J. Rapp, A. C. Christensen, C. R. Cady, L. B. Knight, W. A. Kellogg, W. C. Edgar, C. J. Skeffington, A. E. Smith, G. G. Crewson, W. H. Schulte, B. Castor and C. D. Hollins.

NATIONAL SMELTING CO., Cleveland—Samples of the products manufactured by the company will be shown. R. L. Brown, E. S. Christiansen, A. Rubin and W. M. Weil will be at the booth.

NEW HAVEN SAND BLAST CO., New Haven, Conn.—The booth of this company will be equipped as a rest room for convention visitors. H. C. Nicholas, L. B. Brewster and D. S. Sammis will represent the company.

NEWAYGO ENGINEERING CO., Newaygo, Mich.—This company will feature the various types of foundry equipment that it makes together with photographs of installations and drawings.

NIAGARA CONCRETE MIXER CO., Buffalo—The feature of this exhibit will be a screen for conditioning foundry sands.

Looking Up Michigan Boulevard

WM. H. NICHOLLS CO. INC., Richmond Hill, Long Island, N. Y.—A new type rollover molding machine made in various sizes and a jolt squeeze stripping machine will feature this company's exhibit. Various types of jolt squeezing machine also will be shown. Representatives include William H. Nicholls, Louis R. Schocken, Arthur D. Ziebarth and Gust Anderson.

NORTHERN ENGINEERING WORKS, Detroit—Two electric hoists will feature the display of this company. One of the hoists will be mounted on an overhead frame and monorail I-beam and will be in operation. The other will be unmounted and will have the covers of various parts removed for easy inspection. Henry W. Standart, W. W. Peattie, M. O. Haeger, S. E. Schneider and A. Mohr will represent the company.

NORTON CO., Worcester, Mass.—This company will exhibit various types of grinding wheels, refractories and high speed grinding equipment and will be represented by H. K. Clark, W. N. Jove, W. H. Warner, J. B. Eckstedt and C. A. Carlson.

O

S. OBERMAYER CO., Chicago—Flasks, jackets, bands and a stone mixture used for making patterns, core boxes and hard matches will be shown by this company. Among those representing the company will be S. T. Johnston, E. D. Frohman, Theodore Kauffman Jr., O. W. Josephson, O. J. Peterson, J. J. McDevitt, A. N. Wallin and F. B. Flynn.

OLIVER MACHINERY CO, Grand Rapids, Mich.—The display will contain pattern-shop machinery and equipment consisting of a double arbor saw bench, hand planer and jointer, disk sander, adjustable speed patternshop lathe, band saw machine, and tool grinder. G. C. Conklin, G. W. Crosley, J. E. McLauchlen, J. R. Duthie, Arthur Blake, P. F. Middleton and M. O. Larson will be in attendance.

OSBORN MFG. CO., Cleveland — This booth will be fitted out as a rest room for visitors. Franklin G. Smith, M. W. Zeman, John D. Wise, E. T. Doddridge and R. E. Kiefer, will represent the company.

P

PANGBORN CORP., Hagerstown, Md.—Several reels of motion pictures showing typical installations of the company's equipment in operation in various foundries will be featured. Photographs of other installations and such equipment as sandblast helmets, mixing chambers, etc., also will be exhibited. Thomas W. Pangborn, John C. Pangborn, P. J. Potter and Victor F. Stine will be in attendance.

PARSONS ENGINEERING CORP., Cleveland—Sandblast and dust arrester equipment together with pictures of typical installations will be displayed. Representatives of the company will be: S. S. Parsons, O. C. Sabin, R. J. Wisely, G. F. Walzer, E. L. Beisel, J. J. Carr, F. C. Morey and Fred Reisen.

PENTON PUBLISHING CO., Cleveland—This booth will be equipped for the entertainment of visitors and the display of business publications and technical books. The representatives will be C. J. Stark and J. D. Pease.

PICKANDS, BROWN & CO., Chicago—This company will exhibit samples of pig iron and coke and will be represented by G. A. T. Long, C. M. Pearson, E. A. Bateman, Thomas Glasscot, C. I. Waldo, W. L. McDermott and S. S. Robinson.

PITTSBURGH ELECTRIC FURNACE CORP., Pittsburgh—Photographs and layouts of typical installations of electric furnaces in gray iron, malleable and steel foundries, together with castings made from metal produced in those type furnaces, will be featured at this exhibit. The following men will be at the booth: W. E. Lewis, H. H. Watson, G. L. Simpson, W. E. Moore, W. B. Wallis, W. H. Payne, F. E. Gibson and W. L. Kammerer.

PRODUCTIVE EQUIPMENT CORP., Chicago—A double deck vibrating screen for reclaiming core sands and sandblast sand and reconditioning of shakeout sand will be exhibited. E. L. Westenhaver will be in charge of the booth.

PYROMETER INSTRUMENT CO., New York—This company will display several types of pyrometers including radiation, immersion and optical. The radiation type is for general use, immersion for nonferrous foundries and the optical for iron and steel foundries.

R

ROYER FOUNDRY & MACHINE CO., Wilkes-Barre, Pa.—A complete sand separator and blender, a new type shake-out machine, belts and conveyors, and separate units of various combination types of separators, blenders and scrap removers will feature the exhibit of this company. The sand handling unit will show the shaking-out of a casting from the mold, delivery of the casting and scrap, and delivery of sand to a tempering belt which in turn will carry the sand to a separator and blender thus making the sand ready to be used again. Representatives of the company will include G. F. Royer, S. B. Davies, John Lloyd, William Fenton, Alexander Haigh and Jacob Seitchek.

S

SAFETY FIRST SHOE CO., Framingham, Mass.—Safety shoes with steel inserts

in the toes will be in the display at this booth. Representatives will be Edgar C. Davidson, Albert L. Rohrbacher Jr., J. G. Hallberg and I. S. Granstrom.

Safety Grinding Wheel & Machine Co., Springfield, O.—A display of grinding wheels and photographs of installations of grinding machinery manufactured by this company will be shown at the booth. H. W. Lanyon, A. H. Benner and H. G. Bennett will be in attendance.

Sand Products Corp., Detroit—Core sands of various types and cores made from those products will be shown. The company will be represented by A. N. Farmer, W. I. Salee, M. P. Drennan, C. N. Spidell, N. P. Dessert and W. Maybank.

Schoelkopf Mfg. Co., Madison, Wis.—A mechanism for operating doors automatically will be shown at this booth.

Semet-Solvay Co., New York—Foundry coke, protective paints and plant equipment manufactured by the company will be shown. James M. Woods, Elmer L. Kyle, Samuel Weiss, Albert E. Scherm, Robert H. Watson, Edward J. Rowe, Alfred Fischer, W. E. Shelow, A. P. McClure, T. J. Ryan and John Daker will represent the company.

Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.—Two floor operated, electric hoists, one of the 1-motor, push trolley type of 1000 pounds capacity and the other of a close-clearance, 2-motor, 2-ton, floor operated type, will be displayed. A 3-ton standard crane trolley also will be exhibited. A cross section of a hoist illustrating the construction and general assembly together with a series of enlargements illustrating developments in foundry equipment will be shown. The booth will be in charge of R. T. Turner, F. E. Meeks, G. G. Robbins and Walter B. Briggs.

W. W. Sly Mfg. Co., Cleveland—Photographs, charts, drawings, etc., of foundry cleaning room equipment manufactured by this company will feature this display. Representatives of the company will include: S. C. Vessey, C. P. Guion, E. M. LaMotte, M. T. Mortensen, W. L. Kammerer and F. A. Ebeling.

Werner G. Smith Co., Cleveland—Samples of core oils and specimen cores made from those binders will feature the exhibit of this company. The company will be represented by Werner G. Smith, L. P. Robinson, V. H. Hunter, O. E. Steep, George J. Graham, M. M. Werckman, M. S. Finley, Ray Hunter, Frank H. Dodge, J. C. Gore, John M. Glass, W. E. Rayel, S. E. Shaver, W. J. Bach, Bruce Ross, Lewis F. Ferster, A. S. Coulter and Dr. Wallace Alexander.

Smith Oil & Refining Co., Rockford, Ill.—Cores made from the core oil manufactured by this company will feature the exhibit at this booth. Representatives will include J. B. Perkins, F. C. Maley, O. S. Smith and H. Hlavka.

Spencer Turbine Co., Hartford, Conn.—Turbo-compressors will be exhibited by this company. Representatives will include F. A. Wright, A. W. Peard, C. E. Kauffman, and O. J. Dingee.

Standard Conveyor Co., North St. Paul, Minn.—An extensive exhibit of roller conveyor equipment adapted to foundry use including a loop of the type conveyor manufactured by this company and samples showing bearings and mountings will be featured. P. C. Wego, H. A. McDowell and A. O. Soley will have charge of the exhibit.

Standard Safety Equipment Co., Chicago—Safety devices for machinery and protective devices for workers will be featured at this booth.

Standard Sand & Machine Co., Chicago—The exhibit of this company will feature a sand mixer equipped with a screen and operating model of a roll mixer for the preparation of sand in continuous sand handling systems. Views of typical installations and blueprints of various pieces of apparatus made by this company also will be shown. W. C. Packard and B. W. Roberts will be in charge of the booth.

Standard Silica Co., Chicago—A line of core, molding, furnace bottom, and blast sands together with silica washes will be exhibited by this company.

Steel, Cleveland—This booth will be equipped as a lounge for the entertainment of visitors and the display of business publications and technical books. The representatives will be E. L. Shaner, F. B. Pletcher and L. C. Pelott.

Steelblast Abrasives Co., Cleveland—This company will show samples of shot and grit and various applications. The booth will be in charge of S. S. Parsons, O. C. Sabin, E. L. Beisel, J. J. Carr and L. J. Holzman.

Sterling Wheelbarrow Co., Milwaukee—This display will include rolled steel flasks, wheelbarrows and other foundry specialties. A new design of flask for steel foundry use will be one of the features. H. H. Baker, R. F. Jordan, J. J. Coyne and O. E. Steep will represent the company.

St. Louis Gas & Coke Corp., St. Louis—This booth will be fitted as a rest

The Daily News Building Is One of Chicago's Large Structures

room for visitors. J. Louis Reiber, L. J. Desparois, S. McGovern, T. A. Maloney, R. A. Jacobsen and Frank C. Scheiber will be in attendance.

Stone Pattern Mount Co, Inc., Bloomfield, N. J.—The exhibit of this company will consist of a method of mounting loose patterns on squeezer plates or roll-overs; another method of making match plates, pattern duplicates and core boxes from a non-shrinking compound which produces both a hard and smooth surface. C. W. Quast will be in charge of the exhibit.

Superior Charcoal Iron Co., Grand Rapids, Mich.—Samples of the pig iron manufactured by this company will be featured.

Superior Flake Graphite Co., Chicago—Samples of various grades of graphite, plumbago, blacking, core wash, parting compound, etc., will be shown. In addition the company will display various ferrous and nonferrous castings poured in cores and molds treated by a special process. Representatives will be M. B. Joyce, W. S. Joyce, J. R. Briesemeister and R. A. Sullivan

Swan-Finch Oil Corp., Chicago—This company will show samples of core oils and specimen cores made from those oils. Foundry lubricants also will be exhibited. Nelson V. Joyce, E. N. McQuillen, Thomas E. Kenefick, James E. McCrummey, S. F. Musselman and W. R. Macy will represent the company.

T

Tabor Mfg. Co., Philadelphia—This company will exhibit several new developments in molding machinery together with various pieces of foundry equipment. F. R. Wallace, Leicester S. Lewis, Robert M. Maull, Harry W. Titgen, J. H. Coleman, W. E. Sewell, H. W. Impey, T. L. Sumner, H. L. Ritts, P. J. Shire and J. T. Ramsden will be in attendance.

Truscon Steel Co., Cleveland—Alloy steel foundry flasks, bottom boards, core plates, mold jackets, skid platforms and boxes will be featured in this exhibit. The company will be represented by Oscar W. Loew, Gustave Kahn, N. C. Ferreri, L. S. Todd, H. A. Beattie and J. C. Peirce.

W. S. Tyler Co., Cleveland—The exhibit of this company will include an electric hummer screen, a sand testing sieve shaker and standard screen scale testing sieves.

U

United Compound Co, Buffalo—This company will show samples of vent wax and various methods in which it is used. The company will be represented by L. F. Leney and W. F. Bradley.

Universal Sand Equipment Co., Cleveland—Sand throwing machines and accessories for blending, mixing and aerating foundry sands will be featured. S. L. Dryfoos will be in charge of the exhibit.

V

Vesuvius Crucible Co., Swissvale, Pa.—Graphite crucibles and graphite stoppers will be exhibited by this company.

W

White Rock Silica Co., Chicago—Various types of sands used in the foundry industry will be displayed.

Whiting Corp., Harvey, Ill.—Photographs and moving pictures, showing typical installations of the equipment manufactured by this company will be shown by J. H. Whiting, Col. T. S. Hammond, A. H. McDougall, M. J. Evans, Robert S. Hammond, R. E. Prussing, W. DeVries, L. D. Reed, G. M. Dennis, D. J. Reese, and C. A. Hardy.

Wright Mfg. Co., Bridgeport, Conn.—A line of hoists including high speed, screw, and differential types, and steel trolleys will feature this exihibit.

Z

Zanesville Sand Co., Zanesville, O.—A display of molding, blast and silica sands and fire clay will be shown. The company will be represented by Harry M. Flegal and Fred G. Flegal.

Mechanical Handling Is Subject of Exhibit

The first national exposition of mechanical handling will be held in the Grand Central Palace, New York, Nov. 30 to Dec. 5. The exposition is being held principally for industrial, engineering and technical men interested in mechanical handling problems. The primary purpose is to educate those responsible for handling and distributing operations in various lines of industry. The scope of the exhibition is designed to include all of the motions required to move materials from the natural source to the manufactured product.

Division of simplified practice, bureau of standards, Washington, soon will publish a simplified practice recommendation covering allowable limits for sizing aluminum oxide and silicon carbide abrasive for polishing and grinding wheel manufacture, which recently was approved by the industry.

Gray Iron Industry Realizes Metallurgical Advance

By Ralph S. MacPherran

THERE is a general feeling that the gray iron industry has been more or less standing still and not advancing as fast from a metallurgical standpoint as that of the malleable iron or steel casting industries. The author believes that feeling is an injustice and due perhaps to a lack of appreciation of what has been done in the past few years. Therefore, it should be of interest to give a resume of some of the more recent developments in the gray iron field.

Which of those are the most worthy of attention, would be a matter of personal opinion, but those which follow are at least among the most outstanding. Included in the improvements in melting are the regulation of amount of air, preheating the blast, use of the tilting spout, and the use of the electric, and rotary-type, fuel-fired furnaces. Improvements in material are the development of the process for producing iron with a pearlitic structure in Germany and England and the development of high strength and alloy cast iron.

Measure the Air Supplied

The amount of air supplied to a cupola may be ascertained by devices which measure the number of cubic feet per minute, or the number of pounds per minute. Both of these methods should result in greater uniformity and economy in cupola operation. Preheating of the blast may be by stoves as in the Griffin Wheel Co. process, or by running pipes down inside the cupola lining as done by the American Cast Iron Pipe Co. The details of those processes are a matter of patent record and copies of those patents may be obtained easily by those interested.

One development is the tilting spout which is produced by the introduction of a T-orY-shaped spout in front of the cupola tap hole. That makes it possible to run the iron down either leg or side and allows the operation of the cupola to be continuous. When the iron running down, for example, the right side of the Y has filled the ladle under that side, the cupola tender raises or tilts that side of the spout and the iron runs down the left side of the Y into an empty ladle. The full ladle is then removed and an empty one set in its place. Thus it is not necessary to stop up the cupola. The iron runs out as fast as it melts. The latter has two distinct advantages. It is easier on the crane service, and it lessens the carbon pickup in melting.

Views Progress

FOR his valuable contributions to the foundry industry, Ralph S. MacPherran will receive the Whiting gold medal awarded by the American Foundrymen's association at the annual banquet to be held May 6 in Chicago. Mr. MacPherran is chief chemist of the Allis-Chalmers Mfg. Co., Milwaukee, and has been associated with the iron and steel industry for nearly forty years. In this article he presents a brief resume of some of the major developments which aided materially in promoting progress in the gray iron foundry industry.

In the usual process, the cupola is stopped up from time to time. The iron then backs up, filling the well of the cupola nearly to the slag hole and remains in contact with the coke in the cupola until tapped out. During that period, it picks up considerable carbon from the coke in the bed. In the continuous process, stopping up is avoided and the iron runs out as soon as melted. Therefore, it is possible to get a low carbon product with a lower percentage of steel in the mixture. It has much the same effect as the forehearth in European practice.

Improvements in melting have been obtained through use of the electric furnace. That furnace can be used to melt cold stock, but perhaps is operated more economically by first melting the iron in the cupola and then finishing in the electric furnace. The two main features of the process are the cheap materials such as cast iron borings, bundled sheet steel, etc., which can be used, and the high grade product which can be made. Superheating which seems to be an essential feature of the process has a most beneficial effect on the quality of the material. However, it should be remembered that close care and skillful attention are as necessary with the electric furnace as with any other process.

Rotary Furnace Used

Another improvement in melting is by the use of the rotary-type powdered fuel-fired furnace. The furnace first was developed in Germany, but has been taken up in this country. The melting unit is barrel-shaped which may be rotated on its longitudinal axis and tilted on its lateral axis. Cold stock is charged in through an opening on one end when the furnace is tilted about 40 degrees. After charging the furnace is turned to the horizontal position and the flame of powdered coal injected at the end. The powdered coal used is about 20 per cent of the iron melted and is of a materially lower cost per ton than cupola coke. It is said that there is no oxidation from the flame and the iron is hot.

The process of producing iron with a pearlitic structure is partly a matter of material and partly a matter of application. The process involves pouring the iron into sand molds preheated usually to from 500 to 700 degrees Fahr. As the preheating of the mold delays the cooling of the iron, it makes it possible to use a hard, fine-grained iron in the moderately thin sections. The molds are made and thoroughly dried in the usual manner. They then are assembled with cores and clamped for pouring.

Balls of clay are set in over the gates and risers to exclude the air and the molds put into the high temperature oven for the final heating of from 4 to 6 hours. They are removed from the oven and poured as soon as possible. The temperature of the latter oven will depend upon the thickness of section and the hardness of the iron to be used. A casting with a

cross-section of ⅞-inch sometimes is poured in a mold at 750 degrees Fahr. The iron in such a case would contain about 0.70 per cent silicon. The composition of the irons used in the process will depend upon the purpose, the cross-section of the casting and the mold temperature. One British foundry holds the sum of silicon plus carbon not to exceed 4 per cent.

The use of this process tends to slow up production in the foundry and increases the cost. It makes an unusually fine iron and for some purposes cannot be surpassed. It has a fine grain throughout with a practical freedom from growth at high temperature. The process does not lend itself readily to what we call production, but I am convinced it will some time make a place for itself in this country. It is a patented process and in use by many German and British foundries.

Irons Have High Strength

Perhaps the most important recent development is in the use of high strength and alloy cast irons. One method which is used in the foundry with which the author is associated was described in the Jan. 1, 1930 issue of THE FOUNDRY. In addition to the figures quoted in that article, I may say that 200 consecutive tensile tests recently made on bars with threaded ends cut from an A. S. T. M. standard arbitration test bar and turned in center to 0.505-inch in diameter, broke at an average strength of 55,900 pounds per square inch. This includes bars made with and without nickel. Use of nickel in our foundry is more for machinability than for any possible increase in strength. Where the castings are large and machine work relatively small, neither nickel nor molybdenum are added.

High test cast iron is usually a low carbon iron. That is understood easily. The graphite particles or flakes break up the field and provide planes of weakness during the test. As the number and size of these graphite flakes are diminished, therefore, the tendency is for the strength to increase. A little attention here should perhaps be given to the expression *graphite neuclei*. The theory is that all gray pig iron contains a large number of graphite flakes or particles. All of the graphite may have been dissolved in the iron as it came from the blast furnace. The temperature in the blast furnace is quite high and the solution may have been complete. When remelting the pig iron in a cupola, the temperature is much lower and all the graphite particles are not dissolved.

Those undissolved, of course, go with the iron into the casting and form neuclei of crystallization points around which the iron tends to crystallize first on cooling. In the presence of a considerable number of these neuclei, the resulting crystallization is naturally coarser than where no such neuclei were present. In the absence of such neuclei, the crystallization tends to become more nearly instantaneous which results in a finer grained material. The finer grained iron is usually of greater strength than one where the crystals have grown to a larger size, and where the graphite has developed into flakes.

Strength Is More Uniform

One of the many advantages in the use of high test iron is the more nearly uniform strength in the various sections of the casting. For experimental purposes, we recently made a 25-ton casting of this material, the analysis of which is as follows: Total carbon, 2.73 per cent; silicon, 2.35 per cent; sulphur, 0.090 per cent; phosphorus, 0.08 per cent; manganese, 0.72 per cent, and nickel, none. The casting then was broken up and about 20 test specimens hollow drilled from various parts of the casting. Those drilled from a section 7 inches in thickness broke at 30,000 pounds per square inch, and those cut from a 2½-inch flange broke at 42,000 pounds per square inch. There were no traces of shrinkage in the areas where the ribs joined the body of the casting.

To compare those results better with old practice, we took a large casting of soft gray iron and one of a low-silicon, 25 per cent steel mixture and drilled test specimen from same diameter sections as above. The test specimen from the soft gray iron casting broke at 15,100 pounds per square inch and the specimen from the 25 per cent steel mixture broke at 22,400 pounds per square inch. In an article published in the *Proceedings* of the American Society for Testing Materials, 1929, the author pointed out that a specimen from the center of a 4-inch diameter test bar of soft gray iron broke at about 14,000 pounds per square inch, the center of like section of 25 per cent steel mixture at 19,000 pounds per square inch, and the similar test bar of high test iron broke at 37,000 pounds per square inch.

The largest single casting we have made of our high test cast iron weighed 57 tons. Tensile bars machined from the arbitration test specimen made from the two ladles used for this casting broke at 52,600 and 59,200 pounds per square inch. The analysis was: Carbon, 2.65 per cent; silicon, 2.16 per cent; sulphur, 0.088 per cent; manganese, 0.68 per cent, and nickel, none. The results quoted merely are cited to show the advance in foundry metallurgy and the increased strength it is now possible to obtain in iron castings.

While part of the increased strength may be due to superheating, it is also possible that this same superheating may at times have been the cause of some of the troubles found with high test iron. Bardenheuer and Zeyen, *Kaiser Wilhelm Institut fuer Eisenforschung*, No. 130, found that when superheating high carbon cast iron of normal silicon and manganese content, the graphite can be refined and the strength values increased. However, where the carbon is low the values for transverse load and deflection decrease with superheating.

There also is an increased tendency for dendritic formation. The latter should be avoided by all means possible. Its results are especially bad with transverse stresses. The results of Bardenheuer and Zeyen would indicate that the unfavorable effects of superheating low-carbon iron may be avoided by high silicon content, resiliconizing in ladle, or by the presence of small amounts of chromium.

There has been considerable work done according to Hurst, *Foundry Trade Journal*, Dec. 4, 1930, on the quenching and drawing of alloy cast iron, and in fact this has been successfully done in a number of places. Twigger, *Foundry Trade Journal*, Dec. 25, 1930, states that motor cylinder liners have given good service when so treated. In this as in many other fields, cast iron seems to be following the lead of steel. Questions of fatigue and impact are being worked out and the use of the microscope has become quite general. Work is being done on the nitrogen surface treatment of cast iron and on a case treatment with zirconium.

The gray iron foundry trade is not standing still but is working both hard and effectively to keep in step with progress, and it has made more definite progress in the past ten years than in preceding twenty.

Arbitration Association Publishes Code

American Arbitration association, 521 Fifth avenue, New York, has published a code of arbitration practice and procedure, which is the standard organized practice of arbitration now used by business men and attorneys. The code may be applied to the settlement of business controversies in any jurisdiction in the United States. It is being distributed by the Commerce Clearing House Inc., loose leaf service division, Corporation Trust Co., New York. The work is the result of 5 years experience in the American Arbitration Tribunal. During that period, 2254 disputes were submitted which resulted in 1094 awards.

The code will be accompanied by a monthly information service bulletin called the American Arbitration service which will provide those interested with up-to-date information on arbitration affairs. In addition a personal service is included.

The FOUNDRY Family Photograph Album

Upper Left

W. F. GRAHAM

Caskeys Brass & Bronze Works, Philadelphia

Upper Right

L. M. SHERWIN

Brown & Sharpe Mfg. Co., Providence, R. I.

Lower Left

J. H. LANSING

Danville Malleable Iron Co., Danville, Ill.

Lower Right

W. E. TRUMP

Machined Steel Casting Co., Alliance, O.

PROPOSED MASTER SPECIFICATION FOR

AMORPHOUS CARBON ELECTRODES

GENERAL SPECIFICATION

There are no general specifications applicable to this specification.

GRADES

This specification covers a grade of *amorphous* carbon electrodes for electric steel melting furnaces.

MATERIAL AND WORKMANSHIP

Electrodes furnished under this specification shall be made of bonded, amorphous carbon, and shall be free from materials, defects, or blemishes that may adversely affect their serviceability.

GENERAL REQUIREMENTS

1. The surface of the electrodes shall be free from flat spots, bulges, cracks or any other irregularities which interfere with operations.
2. Electrodes shall be threaded at each end and provided with suitable connecting pins.
3. The threads on electrodes and screw plugs shall be machined to fit

REQUIREMENTS FOR ELECTRODES

Nominal Diameter Inches	Length Inches	Tolerance in diameter (plus or minus) Inch	Maximum variations between axis of electrodes and threaded portion Inch	Maximum specific resistance ohms per cubic inch	Minimum apparent density	Maximum ash content Per cent	Maximum deviation from straight Ohms
8	60	0.12	0.081	0.0014	1.45	10	1/2
10	60	0.15	0.120	0.0014	1.45	10	1/2
12	60	0.20	0.125	0.0014	1.45	10	1/2
14	72	0.21	0.125	0.0018	1.45	10	1/2
17	72	0.255	0.129	0.0022	1.45	10	1/2
20	90	0.30	0.150	0.0022	1.45	10	1/2
24	72	0.36	0.183	0.0022	1.45	10	1/2

freely into one another so that no binding takes place, and at the same time, shall not be so loose as to allow end play when the nipple is pulled or pushed while in position. Good electrical contact shall be secured.

4. The end face shall be in a plane surface or slightly concave. Convex ends will cause rejections. The axis of threading shall coincide, as nearly as practicable with axis of electrodes and the end face shall be at right angles to axis of threads.

5. Each delivery shall include not less than 1 per cent per pound of electrodes joining compound to efficiently bond every electrode to the one adjoining.

DETAIL REQUIREMENTS

Electrodes shall conform to the requirements given in the accompanying table.

Abstracted from a United States government master specification proposed by the federal specification board, Washington.

(*Concluded on Data Sheet No.* 858)

PROPOSED MASTER SPECIFICATION FOR

AMORPHOUS CARBON ELECTRODES

(*Concluded from Data Sheet No.* 857)

METHOD OF INSPECTION AND TESTS

1. Determination of resistivity shall be made on at least 10 per cent taken at random, of the electrodes constituting a delivery. This test shall be conducted at a temperature of not less than 40 degrees Fahr. nor more than 80 degrees Fahr. In the event of any of the electrodes which are taken for test failing to meet the requirements of the specification for resistivity the inspector may at his discretion require that each of the electrodes constituting the delivery be inspected for resistivity.

2. Determination of ash content will be made on one sample taken at random from each delivery of 25 or less electrodes. The sample for the determination of ash content ordinarily will be obtained from across the face of the end of the electrodes.

3. Apparent density shall be computed on the following formula:

$$\text{Apparent density equals} = \frac{\text{Wt. X } 35.3}{(D^2 \text{ X L}) - C}$$

Where D = diameter
L = length
C = equal volume of recesses added together after each recess is determined as follows:
$C = (d^2 \text{ X } 1)$

4. Resistance shall be computed by the following formula:

$$\text{Resistance} = \frac{\text{Volts X } D^2 \text{ X } 785.7}{\text{amps. X L}}$$

Where D = diameter
L = length

PACKING AND MARKING OF SHIPMENTS

1. Electrodes shall be shipped in box cars to avoid the absorption of moisture and shall be properly secured so as to avoid breakage.

2. Each electrode shall be marked plainly with the manufacturer's name, the size and the contract or purchase order number under which delivery is made.

NOTES

1. Amorphous carbon electrodes under this specification are intended for use on electric steel melting furnaces of the arc type.

2. Bids for furnishing electrodes differing from the requirements of this specification will be considered, provided the bidder clearly describes, in his bid, the specific points in which the electrodes he proposes to furnish differ from the requirements of this specification and provided further, that the differences are indicated as such. When exceptions are not clearly described and indicated as such, it will be assumed that bidders are offering electrodes in strict accordance with this specification.

THE FOUNDRY DATA SHEET, APRIL 15, 1931

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Questions & Answers on FOUNDRY PRACTICE

GRAY IRON

Carburizing Pots Fail

We are making pots for carburizing steel castings from a mixture composed of 50 per cent pig iron; 20 per cent scrap and 30 per cent steel. The mixture has the following composition: Silicon, 1.60 per cent; phosphorus, 0.20 per cent; manganese, 0.80 per cent; sulphur, 0.100 per cent, and nickel-chromium, 0.80 per cent. The pots do not last long; some serve only for one heat while others serve for 3 or 4. Is it possible to melt a high percentage of chromium in the cupola without much loss? We have added 3 pounds of chromium and 12 pounds of a nickel-chromium alloy to a 1500-pound ladle of iron, but found that segregation occurred. We would like to use 14 per cent chromium, and also a high percentage of nickel in the pots to withstand the high temperatures encountered. Our cupola is lined to 42 inches with 1500-pound charges. The bed is a little over 30 inches above the one row of tuyeres in the cupola.

The mixture you are using appears to be an ordinary gray iron, possibly mottled in thin sections, from which it is not logical to expect unusually good life under the high temperature conditions. You have not indicated whether most of your troubles come from scaling or from cracking. In either case, using the pots you have, increase in life can be obtained through extra care in certain details of carburizing furnace operation. In heating the pots in the furnace an excess of air will cause scaling which is rapid at the temperatures involved. A slight excess of gas or oil will reduce scaling and increase the life of the pots. If an electric furnace is used, all openings should be closed and some carbonaceous material thrown into the furnace. That material will react with the excess oxygen in the furnace atmosphere. However, an excessively reducing atmosphere is somewhat detrimental to the life of the resistors of an electric furnace. Insofar as cracking is concerned, rapid heating and cooling is to be avoided.

Undoubtedly, use of special mixtures will increase the life of the pots, and also the initial cost. If you desire to try a mixture without alloys, it is suggested that you try one similar to that used for making annealing pots for malleable cast iron. The silicon is low, about 0.75 to 0.80 per cent; phosphorus, around 0.20 per cent; manganese low, say 0.40 per cent; sulphur the higher the better, especially if you can get it to 0.200 per cent, and total carbon as low as can be obtained by large additions of steel scrap.

Special iron alloy pots may be found to give exceptionally long life. One alloy iron containing nickel, chromium and copper is said to have good scale resisting properties. At 1500 degrees Fahr. it is claimed to be 10 times more scale resistant than ordinary gray iron. The relative resistance diminishes rather rapidly above that temperature. The alloy iron is made with 20 per cent monel metal added to the cupola charge and 2 to 3 per cent chromium as ferrochromium added to the ladle. For your purpose a higher chromium content may be desirable, say 6 to 8 per cent. Low silicon from 0.50 to 1.0 per cent and high sulphur from 0.15 to 0.200 per cent also are desirable. Manganese should be kept low, not over 0.50 per cent. Hot melting is necessary, and the ferrochromium should be heated before adding to the ladle. It should be in small pieces and dropped into the stream emerging from the cupola spout. Also increase the size of the gates and risers in the mold to about twice the size of those used for ordinary gray iron. Another mixture suggested for the pots contains about 25 per cent of a nickel-chromium bearing pig iron. The silicon, phosphorus and carbon should be kept low.

Segregation which you encountered may be due to the metal not being hot enough, or failure to stir the metal well before pouring. While it may be possible to produce a 14 per cent chromium alloy in the cupola, the losses would be so high as to make the process prohibitive. Such alloys usually are melted in the electric furnace.

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions must be addressed to the Editor, The Foundry, Penton Building, Cleveland.

Q & A

Molds Brake Shoes

We are interested in the manufacture of cast iron brake shoes for freight cars, and would like to have some information on their manufacture.

Brake shoes for freight cars are made with and without inserts. The use of inserts is a proprietary process controlled by the American Car & Foundry Co., New York. Shoes without inserts usually are poured from an iron with the following range of composition: Silicon, 1.40 to 1.60 per cent; manganese, 0.50 to 0.70 per cent; phosphorus, under 0.50 per cent, and sulphur, 0.08 to 0.10 per cent. The

shoes are made on two molding machines, one for the copes and the other for the drags. They are poured wearing face down. The patterns are mounted two up, and are attached in the case of the drag machine, to a bar which is actuated by a lever at the side of the machine. Action of the lever and bar drops the patterns through a stripping plate.

The cope machine pattern is a plain plate with the contour of the upper side of the castings integral with the face. A small core rammed up in the cope forms the loop or eye which holds the brake shoe in operation. Any molding machine manufacturer can supply machines especially designed for brake shoe production.

GENERAL

Look Down the Riser

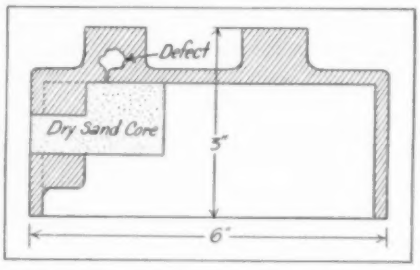
In a former letter you suggested that the vent from the small dry sand core was responsible for the cavity in the boss immediately above. We omitted this core from several castings but the cavity appeared just the same. Then we tried coring out the boss with a core ⅝-inch diameter and ¾-inch deep, but the boss still is defective. The analysis of the iron shows: Silicon 2.50 per cent; sulphur 0.165 per cent; manganese 0.43 per cent; phosphorus 0.19 per cent.

At this distance and from the evidence submitted we are at a loss to suggest any further probable cause for the cavity in the gear case boss shown in the accompanying illustration. Out of several bosses on top of the casting, this is the only one affected. If the trouble was due to the metal, the height of the sprue, or the condition of the green sand in the mold, all the bosses and perhaps other parts of the casting would show defects.

The hole in the casting submitted for examination, clearly is a gas hole, and the most probable source of the gas is the dry sand stop-off core employed for forming a small hole in the side wall of the casting immediately below the defective boss. The fact that a cavity appeared in castings from which this core purposely was omitted, does not disprove the theory. With the core omitted, an entirely different condition was presented. If you left the core out and at the same time failed to fill the core print with sand, the extra thickness of metal at the point in the new casting, caused a shrinkage cavity to form in the area occupied by the gas cavity in the former casting. Also, if you omitted the dry sand core, but packed the cavity too hard with green sand that was too damp, the same condition was present. Steam from the patch rose into the boss and some of it was held by the congealing metal.

Placing a 5/16-inch core, ¾-inch high in the boss, certainly would prevent the metal from developing a shrinkage cavity, but if provision is not made to take the vent from this core through the sand, the gas will form a cavity in the casting as in the first instance.

To determine this point to your own satisfaction, place a riser on the offending boss and then watch down this riser while the iron is rising in the mold. If the metal flutters around the core, you will realize where the trouble lies and take the necessary steps to correct it. In some instances a riser in this position has been known



The Cavity Appeared in the Boss Above the Small Dry Sand Core

to cure a similar trouble The gas cavity forms at a point in the riser above the top of the boss and naturally—since the body of metal in the riser never is broken into small sections—the cavity never is seen. However, the surest way is to provide a mold that will not throw gas or steam into the the metal in bosses or pockets. The analysis of the metal has no bearing on the problem, but our curiosity is aroused by the exceedingly high sulphur, 0.165 per cent and the low phosphorus, 0.19 per cent.

Q & A

Slag Not Granulated

Have you any information on the granulation of slag emerging from the cupola, and the method of handling the granulated slag? For what purposes can such slag be used? Have you any details on preparing granulated slag for road material?

As a general rule, foundries in this country do not resort to granulation of slag from the cupola. The only foundries which would have any slag disposal problem will include the large pipe foundries, automotive foundries, etc., and as far as we know, the slag is handled in the usual fashion. The slag is allowed either to run into a shallow bed formed with floor sand, or into containers such as wheelbarrows, iron pots mounted on a two-wheeled cart, or conveyed on an overhead tramrail system. The slag is taken to a dump after it is solid.

Usually the slag is employed for filling up low portions on the foundries' own premises, or adjoining land, or is transported to other vicinities where filling is desired. One foundry located in a small community used to supply the broken slag to the city for making road foundations. The slag later was covered with cinders to form a usable surface. The slag in that instance was allowed to flow from the cupola into wheelbarrows lined with sand. While still molten it was dumped in the yard, allowed to freeze, and then was broken up with a pick.

Considerable slag from blast furnaces is granulated for cement making, and ballast for railroads. The slag flowing from the furnace meets a stream of water flowing from a 2 or 3-inch nozzle which breaks it up. The granulated material falls into a large pit full of water from which it is removed by a clam-shell bucket. Slag from a cupola undoubtedly could be granulated in the same manner, but usually there is not enough slag produced to make it worthwhile.

Q & A

Apply Phenol Binders

Recently we came across a refercnce to the use of phenolic compounds for a binding agent for cores. What are they, and how are they used for core binders?

Phenolic resins are synthetic compounds formed by the condensation of equimolecular portions of phenol and formaldehyde which forms a viscous substance which later is solidified with heat under pressure. Some of the phenolic resins are black in color, and others are practically transparent and light in color. They are used for a variety of purposes including electrical and acid resisting apparatus. Recently, a liquid phenolic resin which is solidified with heat, was placed on the market for use as a binder in cores for foundry application.

It is claimed that the liquid resin is used similarly to an oil base binder, and in about the same proportion. Mechanical mixing from 7 to 10 minutes is suggested to give the proper dispersion. It is said to be particularly applicable in making aluminum and brass castings or intricate iron castings. It is not so satisfactory for heavy work as the bond breaks down a little too soon under high casting temperatures.

The metal is said to lie quietly against a core made with the resin binder, and the cores may be removed from the castings easily. The used core sand may be used over again without having to increase the amount of bond over that originally used, provided nothing but phenolic resin was employed as the binder. The cores are baked at oven temperatures ranging from 425 to 500 degrees Fahr., and a saving of one-half to two-thirds the baking time is claimed. For example, it is stated that radiator cores which usually require a 2-hour cycle may be baked in ½-hour.

Problems in Nonferrous Founding

By Charles Vickers

Fluxes Protect Metal

We have used a number of different fluxes in melting brass, along with powdered charcoal and borax. These fluxes are not used as a cure-all but more as a safeguard and precaution, as we operate our oil-fired, crucible-pit furnaces, with as near a neutral flame as possible. Will you suggest an adequate flux which will perform approximately the following: (a) Care for excess oxygen when a slightly oxidizing flame is being used. (b) Become sufficiently fluid to make a covering over the metal, and not be blown away. (c) Have a tendency to form a crust instead of a more fluid slag such as glass would cause; (d) Have no wearing action whatever on the inside of the pot; Also what would be an appropriate mixture for refining the metal, and removing aluminum from red brass mixtures.

From the questions there seems to be a misconception of the action of the fluxes used in brass melting in crucibles. They do not cure anything, neither do they deoxidize the metal. They merely shield it from the action of the flame. If it is necessary to deoxidize and fluidize, use a small amount of phosphorus in a red brass. About 1½ ounces of phosphor-copper, which contains 15 per cent phosphorus, is sufficient for red brass. There is nothing gained in melting by striving for as near a neutral flame as possible unless you can analyze the furnace gases frequently. It is too easy to slip over to a reducing flame, and get a lot of spongy castings, and other defectives. Use a slightly oxidizing flame. If the furnaces are properly designed they will melt 200 pounds of red brass in 1 hour starting cold, and in little more than half that time starting hot. In such case all the flux used by many foundrymen is a little borax in the bottom of the pot when starting off. When such results are attained there is no time for oxidation of the metal, as it quickly sinks and a light slag forms on top to cover it.

The flux we would suggest is glass, or some mixture that melts to a glass. Use merely a light film on a rapid melting furnace. Manufactured fluxes sold for brass melting are convenient to use and melt to a fluid that is neither too thin nor too thick, when used correctly. Consult the advertising pages of THE FOUNDRY for sources of supply of these fluxes.

Some manufacturers state that their fluxes will remove aluminum from red brass but the better way is to be careful not to add aluminum when charging the brass. However, should some get into the pot, and there is a flux at hand to remove it, the brass will be greatly improved. Aluminum is a potent deoxidizer, provided that after doing its work none is left alloyed with the metal.

Q & A

Bronze Contains Holes

We have considerable bronze in our foundry, and every so often we have trouble with the metal. The metal appears to be clean, but it is full of holes, and we presume that oxides are responsible. Can you give us a sure cure for the trouble?

Since you do not give any definite information that would assist in determining possible causes of the holes, no cure, sure or otherwise, can be suggested. That is due to the fact that a number of causes may be responsible for the holes. It may be due to improper melting practice, poor metal, or molding methods. However, if the metal is clean as you mention, the holes may not be due to oxidation as that usually causes discolored holes. Check up on your molding practice and see that the sand is not too wet, and that your cores are made and vented correctly. It also is suggested that you add one or two ounces of phosphor-copper per hundred pounds of metal to deoxidize it. If that fails to eliminate the holes, it may be that you are melting with a reducing flame if oil furnaces are used. If the addition of litharge or lead oxide to the molten metal eliminates the holes, then the latter condition of melting is present. Correct the condition by increasing the amount of air admitted to the burner. All too often, foundrymen in their fear of oxidizing the metal, have a tendency to use the reducing flame in melting. Consequently, they obtain castings which are porous or contain gas holes.

Makes Phosphor Bronze

We would like to obtain some information on making phosphor-bronze bearings. We melt in a crucible tilting type gas-fired furnace using a No. 60 crucible. The type of bearings we make will weigh from 30 to 70 pounds each. We expect to use the following mixture: 73 per cent copper; 10.50 per cent tin; 12.50 per cent lead; and 4 per cent phosphor-copper, the latter containing 15 per cent phosphorus; We will appreciate any information you can give us regarding the suitability of the above mixture, proper molding methods and the correct pouring procedure,

The molding sand must not be finer than a No. 1 grade, and probably a 50-50 mixture of Nos. 1 and 2 grades of sand would be better for the molds. If the bearings are in the shape of bushings the long ones are usually made horizontal and with a core through them. While the short ones are often made vertically, and leave their own cores in greensand. With 4 per cent phosphor-copper, the metal will be liquid and may search into the dry sand cores, so they will have to be coated with a heavy coat of plumbago. The metal will have to be poured on the cool side. That will be indicated when the metal begins to film over from the sides of the pot, and the little specks of slag no longer arise and coalesce so vigorously as at first. The pouring has to be done quickly and with decision, because the bronze, once it has reached the pouring temperature quickly sets.

The tilting type of furnace mentioned will be satisfactory, provided the flame is so adjusted that it is slightly oxidizing. A thin slag on the metal such as comes from the addition of two small handfuls of calcined borax or boric acid will be sufficient cover. Add the phosphor copper when the latter is just molten, and let it work while the copper is getting hot enough to add the white metals. In later heats when gates are used melt them together with the copper part of the charge, and to prevent building up of the phosphorus when gates and copper are used, add phosphorus only for the new portion of the charge, and do not re-phosphorize the gates and sprues.

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
Managing Editor

PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶ From Outside—Looking In

REGULAR readers of THE FOUNDRY and particularly those who have been subscribers and friends for many years, will encounter a surprise in this issue. For the first time in nearly forty years, this publication has deviated from established practice and stepped outside the foundry industry. The lead article and the symposium of expressions which follow cannot by any analysis be classified as relating to foundry practice nor the technical or business aspects of castings manufacture. Why, then, should this material appear in this publication?

TO THE man who has read the articles mentioned, no explanation is necessary. To that member of the foundry industry, who has glanced through this issue to this page and who has *not* read carefully and thoroughly every line of the first forty editorial pages of this issue, this answer may be given. Many, who are intimately identified with castings manufacture, have no adequate picture of the breadth and scope of service of the foundry industry. They fail to realize the importance of the work they do and the dependence of practically every phase of modern life upon some of the many elements of the foundry industry. To such as lack this vision and appreciation, the articles which appear in this issue will be a new revelation.

THOSE who have a far reaching knowledge of the part played by the foundry industry also will profit from a study of these articles. An outside viewpoint often is necessary to a study of faults and shortcomings. It also is valuable to a true appraisal of worth. The entire feature is an appreciation of the foundry industry, expressed by those who are qualified judges.

¶ Survey Pig Iron Output

FOUNDRY pig iron production, according to statistics just released by the American Iron and Steel institute, showed a decline in 1930, the total foundry grades being given as 3,622,779 tons. The 1929 production was 4,446,001 tons, showing a decrease of 18.52 per cent in the total output of foundry grades during 1930. However, the summary of all grades of pig iron reported to the institute shows a decline of 25.71 per cent in 1930 as compared to 1929. Since foundries purchased little iron in excess of immediate needs, it would seem that 1930 production of gray iron castings was not out of line.

MALLEABLE grades which in recent years have entered largely into mixtures for certain classes of gray iron castings, show a decline of 32.05 per cent, larger than the percentage decrease in the total of all classes. An increasing use of ferrosilicon, an interesting phase of this statistical summary, is evident from the fact that the decline in the production of ferrosilicon was only 1.05 per cent in 1930 as compared with 1929. The total production of pig iron of all grades for 1930 was 31,020,907, the lowest output of a five-year period, while 1929 with a total of 41,757,215, represents the peak.

¶ When the Eye Is Quicker

THIS one is vouched for by a steel foundryman. A firm asked for prices on a fair order of steel castings and the buyer placed an inquiry with the foundry which regularly made its work. The foundryman and customers were friends and their business relations were of long standing. In calling in person to look over the job, the foundryman quoted a price of six cents a pound on the job, and while the buyer was considering the offer, his 'phone rang and the one sided conversation gave the foundryman the impression that someone else was inquiring about the job in question. At any rate the buyer said, "No, that matter has not been closed, yet," jotted down some figures and left his desk.

THE foundryman was adept at desk reading—in others' offices. He contrived to read the figures on the pad—five two five. So when the buyer returned, the foundrymen withdrew his original price, stating that a miscalculation had been made and the price should have been five cents a pound. He got the job. Whether he made any money on the order is another story.

THE purchaser knew what had happened. In fact he contrived the situation and gave the foundryman the chance to read the figures. But his telephone conversation was with a salesman for a drapery firm endeavoring to interest the castings buyer in some decorations for his new home. The samples were to be shown in a room at the hotel-room 525.

Moral. No salesman should take a room below the eighth floor.

STEEL FOUNDERS Diagnose Sales Problems

Clinic at Columbus Discusses Selling Castings by Piece, Weight or Schedule

STEEL foundrymen are keenly interested in sales problems in relation to their industry as was demonstrated by an attendance of over 100 executives, sales managers and salesmen that attended a sales clinic under auspices of the Steel Founders' Society of America, at Columbus, O., March 20. The sales meeting, which was held the second day of a two-day district meeting, was conducted by E. St. Elmo Lewis, Philadelphia. In introducing Mr. Lewis, Granville P. Rogers, managing director of the society, deprecated the attitude of many manufacturing organizations where a salesman's views are discounted and his opinions discredited. The fact that the Steel Founders' society hold a different opinion of the value of a good sales organization is evidenced by the study made by the society covering faults in selling methods of steel castings and suggestions advanced both by buyers and foundry sales managers setting forth fundamental considerations in selling castings. This study was summarized in THE FOUNDRY of March 15. Mr. Rogers believes that the three most essential elements in salesmanship are faith in product, concentration upon the needs of the buyer and thorough co-operation in the manufacturing organization.

Help the Buyer to Buy

Mr. Lewis stressed the value of the buyers' attitude of mind as a determining factor in successful sales. He believes that a fundamental consideration in any sales organization is remuneration. Everyone whose services affect profit must be interested in profit. Salesmen like an immediate appreciation of valuable service. A knowledge of the use is paramount in helping the buyer to buy.

One of the moot questions and one about which a great deal of the following discussion revolved was whether castings should be sold upon a price per piece or by weight or schedule. The difference seemed to lie between the manufacturer of large castings and the foundry which makes medium size or small work. The large castings manufacturer favors a schedule of prices varying within certain weight ranges and classified only roughly into subdivisions. The value of a price per piece on repetition work was acknowledged. One difficulty confronting the castings salesman is the inability to estimate costs accurately without thorough study and co-operation with the operating department. In general foundries favor price quotations being made *only* upon authority of executives.

A warm discussion centered around 27 topics submitted for this conference. One of the elements which constantly was presented was the inability of castings salesmen to avoid a discussion based solely upon price. The question of misrepresentation by buyers, of prices supposed to have been quoted by competing foundries resolved into an experience meeting. The majority opinion of those who discussed this question seemed to be that a closer co-operation between competing foundries would alleviate this element of misrepresentation.

Dumping Fails to Benefit

The question of dumping at low and unprofitable prices in territories outside the natural sales radius of individual foundries also was warmly discussed. Apparently this practice, encountered in practically every industry under prevailing business conditions, is particularly acute in the steel foundry business. The fallacy of mere tonnage as opposed to moderate operation at a profit was held to be true without argument. Therefore, those foundries which are selling outside their normal territory, below profit in the aggregate, lower the entire price structure, and with the present limited market fail to achieve the benefit of full-time or capacity operation which they seek.

The topics of the meeting covered a wide range of vital problems. Altering original quotations, special considerations such as free machine work, free pattern work, special discounts, freight allowance and many other questions were presented for consideration.

Sales managers were advised to direct their sales organizations more carefully. An analyzing of prospects according to the character and scope of their requirements was suggested as a means of conserving salesmen's time. One foundry reported a division of its prospect list into class A, B, C and D customers. Salesmen call upon class A and B customers at least once a month. Class C customers are interviewed perhaps once a year and class D customers receive calls from the foundry salesmen only when time is available which cannot be expended upon the other classifications. Advertising matter specifically addressed to the class C and D prospects has been found effective. An increasing number of foundries report the use of business paper advertising and a few supplement this sales effort by direct mail printed pieces and circular wrappers.

Steel Castings Recommended

The first day of the session was devoted largely to design and new uses problems. Prof. W. Trinks, department of mechanical engineering, Carnegie Institute of Technology, Pittsburgh, explained the fundamental considerations which govern the selection of materials and stressed those factors which will serve to increase the use and service of steel castings. The designing engineer faced with the problem of selection is governed by the fundamental rule of using the cheapest material that will successfully serve. The ability to meet peak demands and unexpected stress has recommended steel castings strongly to the designer of steel mill machinery.

The suggestion was advanced that some unified, central organization, sponsored by manufacturers should have the responsilibity for revising data on physical properties of materials for designing engineers and that such data should include figures on comparative costs, not available in books of specifications and standards.

In the discussion following Professor Trink's paper, C. S. Koch, Fort Pitt Steel Casting Co., McKeesport, Pa., questioned an inference of Professor Trinks that a forging is stronger than a casting. He asked if any

(*Concluded on Page* 134)

BILL

By Pat Dwyer

Tells Why Sand Falls From Cope

CONTRARY to Bill's usual custom, he sat for about an hour the other night in almost complete silence. To an occasional remark on my part he returned short, absent minded answers. Plainly, the old boy was in deep distress and I debated mentally the advisability of trying to draw him out with a leading question or two. Curiosity, as I have been at pains to point out on former occasions, is not one of my leading characteristics. If there is one thing I dislike more than another it is for people to ask me silly questions. For the same reason I respect the right of others to maintain silence if and when they choose to do so. The bright little fellow who cheerfully bursts in on a train of thought with the highly original remark that he is prepared to offer a penny for my thoughts, would get the supreme shock of his young life if I told him what I should like to tell him. Perhaps, some day when the wind and weather are favorable, when I am cold and hungry, essence of vinegar dripping at every pore, I shall treat myself to that pleasure.

My only regret, or rather my only fear, is that when that auspicious moment arives, the words will not come in sufficient volume or with sufficient, vitroilic intensity to do justice to the occasion. One of these days—when I have the time to lash myself to the proper roaring stage—I shall compose and rehearse something suitable. 'Tis a noble resolution—if I only can keep it in mind.

You probably have noticed in your own experience that you never are prepared to meet a supreme crisis of this kind. The jolly old mind goes into a trance and the nimble tongue might just as well be an insipid slice of liver, for all the assistance it renders. After the incident is closed, after the enemy has departed with all the spoils of war and with banners bravely flying, your mind begins to function with amazing clarity. You can think of at least forty annihiliating sentences, any one of which would have burned the enemy to a dark black wind blown cinder.

Toying with the alluring possibilities, tentatively turning over a few preliminary remarks to be expanded, sharpened and poisoned later, the time passed pleasantly. From a contemplation of the future my mind passed by easy stages to a review of sundry incidents in the past. The recollection was not so pleasant. How easily I could have said, thus and so, and left the enemy gnashing his teeth if he had any teeth left to gnash.

Speak Up My Boy. What's the Answer?

My reverie was interrupted by Bill remarking that he guessed he would have to give it up.

"Give what up?" I naturally inquired. "Your job, your dinner, your old car, your habit of chewing tobacco or your proposal to attend the next convention in Chicago?"

"Say!" Bill shouted. "That's a happy inspiration. Perhaps I'll find some bird there to give me the answer."

"Very likely," I admitted. "Some bird where and an answer to what? Kindly make allowance for the fact that I am not a mind reader. You have sat there for the past hour giving a highly finished imitation of Rodin's *Thinker*. What's on your mind? Some job down at the shop that has you stopped?"

"No," Bill said. "It is not a job down at the shop. I have handled so many peculiar jobs at one time or another—dash it all, that's what makes this thing so aggravating. Here's something I have seen hundreds of times, ever since I was an apprentice and yet when a fellow comes along and asks me to explain it to him, I am stumped, absolutely up a tree."

"You intrigue me strangely, my good man," I hastened to assure him. "I cannot imagine any possible question for which you had no answer, particularly if the question pertains to foundry practice. I always have been under the impression that you were the original lad who put found in foundry. What was this profound question for which you neither could give nor fake an answer?" "Well," said Bill, "I'll tell you. You have poked around the foundry to some extent yourself and you have had the advantage of consorting with some able men—mentioning no names—and yet I am willing to bet you four dollars and a half right now, that you don't know the answer to this one." "Four dollars and a half is quite a sum of money," I admitted cautiously, "I have seen the day when it represented my total stipend for two weeks of the most gruelling labor. While it is true that I now earn that amount in a slightly shorter time, still that is no reason why I should wager it recklessly on something which my inner conscienceness warns me is a sure thing. That is a sure thing for you. If you have hatched up this scheme for the nefarious purpose of doing me out of—what is the proper sporting term? Ah, yes, a sizable wad of jack—if you have hatched up this scheme for the purpose of cleaning me out financially, you are going to be disappointed. I can advance 47 reasons for this opinion. The first reason is that I don't own four dollars and a half. The second reason is—"

"The first is quite sufficient," Bill remarked drily. "However, the bet was more of what these here now high brow lads call a rhetorical gesture than a serious offer to drag any of the dough out of your little weasel skin purse. As I said before, I shall save this question until the gathering of the clans in Chicago and then we shall see what we shall see. Now what do you think of that?"

"Suit yourself," I said with a fine assumption of carelessness "but don't forget the fable of the lion and the mouse."

"The lion and the mouse? Har, har! I get ye kid. The noble lion

was caught in a net and the wee mousie gnawed the strings and set him free. My own personal opinion is that story is a lot of baloney. The lion would die of starvation before the mouse could gnaw his way half way through all those tough cords. However, if you want to whet up the yellow snags and have a go at the net in which I am entangled, here's

Offhand the Prospects Look Rather Slim

your chance. Now then get the old snappers all set. How do you account for the fact that a piece of cold metal will float in a ladle of molten metal? Just try your sharp little teeth on that one!"

"Why should it not float?" I asked in astonishment, "I have placed gates and pieces of scrap in ladles hundreds of times for the purpose of cooling the metal. What is there remarkable about that?"

"That is not the question," Bill explained, patiently. "The question is not why the metal does not float. The question is why does it float? I have been accustomed all my life even as you have been accustomed, to see cold metal float on molten metal. The fact that this constituted a natural phenomenon never occured to me until I was asked the other day for an explanation."

"Well," I persisted, "Why should it not float? Ice floats on water—"

"Oh, sure. I know all about that. Wood also floats on water and so does a steel boat. Seems to me I have heard of floating loans and floating kidneys. Clouds float in the sky and the heroine always floats into the ball room. Men who drift from one job to another, independent gentlemen who refuse to sell their services permanently, are known as floaters. Dried herrings also are called—no that's something else.

"All these things conform to well known laws of nature and require no explanation. Solid iron floating on molten iron is in direct opposition to all these laws. Ice floats on water for the simple reason that water expands when it freezes. A hunk of ice is greater in volume than the amount of water from which it was formed. Consequently when the ice is placed in a body of water it sinks until it displaces an equal weight of water. Then it floats. The rule holds irrespective of the size of the piece. A 1-inch cube of ice or an iceberg as big as a mountain, will sink in water until approximately seven-eighths of the bulk is submerged. The remaining eighth will remain above the surface and the entire body will float, if the water is deeper than the submerged part of the entire body. A steel boat will float for the same reason. The hull sinks until a body of water is displaced equal in weight to the weight of the boat. If the weight of the boat was greater than the amount of water it displaced, the boat would drop to the bottom like a stone." "There's your answer," I pointed out. "The piece of scrap, the gate or the sprue sinks in the molten metal until it displaces its own weight and then It floats. Nothing remarkable about that. I've seen it happen a million times."

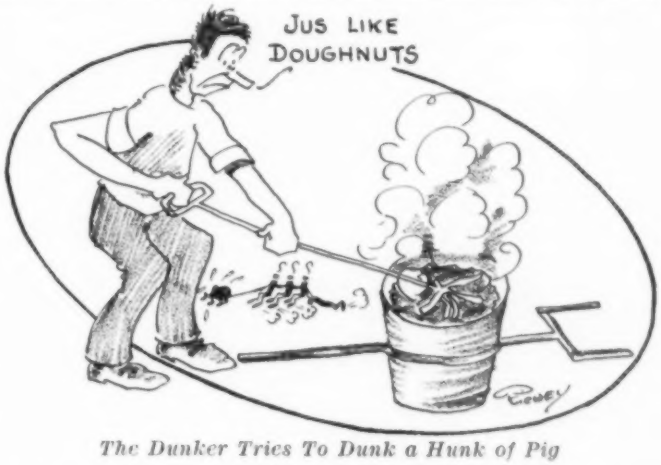
"Sez you!" Bill remarked in disgust. "Say, did you ever happen to think that iron shrinks when it cools? A piece of solid iron weighs more than the same volume of iron in the molten state. Therefore, Q. E. D., as our old friend Euclid was wont to remark on sundry and divers occasions,—get that, divers—a solid piece of iron should plop to the bottom of a ladle of molten iron. The specific gravity of wood is less than water, therefore, the wood floats on water. The specific gravity of cold iron is 7.20. The specific gravity of molten iron is 6.64, therefore by all the laws of nature and common sense it, the solid iron, should sink. Now, my dear lad, what is the answer to that?"

"I never considered the problem in that light," I was forced to admit. "However, the fact remains that solid iron will float. Why should you worry about the reason? Does any person hold you responsible?"

"Well," said Bill, "I'll tell you. I am not exactly worrying about the thing, but, just the same I should like to know. My professional pride is suffering from a severe rap in the slats. Though culpable negligence I have failed to acquire knowledge on a certain point and as a result, I am wide open and defenseless when an opponent slips a fast one over the guard."

"If I were in your place," I said, "I would dismiss the entire incident from my mind. Tell the inquirer that you do not know anything about it and then forget it. Even if you knew the answer, you would be no better off than you are now. You know that cold iron will float in molten iron. For all practical purposes, that is all you need to know. Who cares why it floats? I don't know why it floats. You don't know, and I am willing to lay a small wager that if you were to ask 100 foundrymen tomorrow, not a single one of them could tell you, despite the fact that every one has dunked a piece of scrap in a ladle hundreds of times in his own practice."

"You have hit nearer the mark than perhaps you expected," Bill replied, "both in the use of the term dunking and in broadcasting the inquiry. I attended a foundrymens meeting recently and while circulating among the gang I put the question singly to quite a number. Every one professed familiarity with the phenomenon, but none could offer any explanation. Practically without exception, each one admitted that the idea of seeking the underlying cause never had occurred to him. In a few instances I was told confidently that the cold iron floated because it was lighter, bulk for bulk, than molten iron. When I pointed out—as I point-



The Dunker Tries To Dunk a Hunk of Pig

ed out to you a few minutes ago—that iron shrinks when cooling and therefore the bulk of any given quantity is reduced, they immediately admitted the truth of my contention and agreed that the subject was a mystery. They dismissed the question airily as of no consequence.

"Two gentlemen presented apparently plausible theories, but neither one satisfied me. Both were based on the theory of surface tension, an

excellent theory in itself, but I am not convinced that it applies in this particular instance and I'll tell you why!

"Illustrating the first theory, the speaker said if a piece of sandstone is dropped into water it will sink. If the same piece of sandstone is reduced to powder and then thrown upon the water it will float. My objection to this theory as an explanation for iron floating, is that the cases are not analgous. The iron is not reduced to a powder. The sandstone in powdered form occupies a far greater space than the stone in solid form and besides, the mass is impregnated with air. If allowed to stand a sufficient length of time, the water will displace the air and the mass will sink to the bottom. A piece of iron will float as long as it remains in the solid state.

"In proof of the surface tension theory, the second speaker directed attention to the familiar example of floating a needle on water. If the needle is placed horizontally and with the greatest care, the surface tension is sufficient to keep it afloat. It will not float on end and it will not float horizontally unless it is perfectly dry. The least touch of dampness will send it to the bottom and once it is down, it is down to stay.

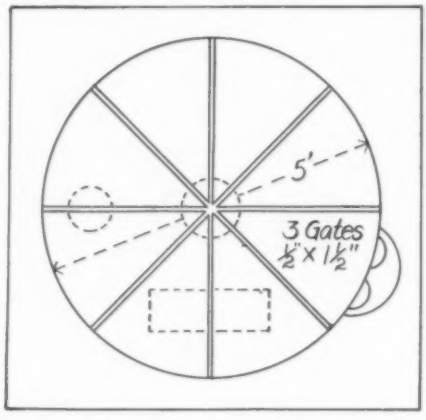
"Here's where your reference to dunking comes in. I might accept the surface tension theory for supporting the iron when first placed in the ladle, but the iron continues to float after the surface tension has been broken by repeated dunking. You can push the piece down with a skimmer, but it will bob up again apparently as light as a cork.

"I'll just take the thing to Chicago with me and bring it up at one of the meetings under the heading: Good and welfare of the order. In the meantime, dear brethern, let us consider another inquiry I had the other day from a man who wondered why the sand pulled down from the cope face of his molds.

"He makes semisteel castings from 20 to 6000 pounds in green sand molds and finds that the sand draws down from the face of the gaggers on all flat molds. Many of the molds are formed with sweeps and yet he has no trouble with scabs or other imperfections on the drag side of the castings. Recently he lost a casting 5 feet diameter, 1⅝-inch thick, with a set of ribs on the cope side and a long stuffing box neck on the drag side. The ribs were shallow, tapering from a height of 1-inch in the center to nothing at the perimeter. The cope sand drew down practically all over the face, particularly in an area about 12 inches wide from the rim. He has had the same trouble on flat rings 2 inches thick and from 8 to 10 inches wide. He wanted to know if I could recommend a good source of sand supply suitable for his work.

"From the evidence submitted I am inclined to the opinion that the manipulation of the sand and not the sand itself is responsible for the trouble he is having on the flat face castings. Sand from his district enjoys an excellent reputation and is employed extensively by foundries in the vicinity which have achieved an enviable reputation both for the quality and the surface appearance of their castings.

"In referring to the casting shown in the illustration he did not state whether the drag was formed by a sweep attached to a spindle arm, or, by a skeleton pattern from which a



The Casting Was Poured with the Ribs in the Cope

thickness of sand was removed by a suitable strike or scraper after the cope was lifted. In either event it is probable that the cope was rammed directly on the drag. Many molders fall into a natural error in preparing a mold after this manner. Knowing the danger of a hard drag, they ram the sand softly and as a result it is not sufficiently rigid to ram the cope sand against. To prevent indentation of the gaggers they riddle at least a 1-inch thickness of sand over the face of the pattern before they set the gaggers. They use an excessive amount of claywash or paste on the gaggers and then they ram the first course of sand gingerly, to prevent possible distortion of the face at the joint line.

"Sand on the face of a cope of that kind cannot be expected to resist the combined heat and the erosive action of the flowing metal. It simply falls off. The sand in the center of the cope face shown in the sketch, stayed in place because—probably—the molder nailed the sand on each side of the ribs for some distance from the center.

"Offhand and basing my opinion entirely on the evidence submitted, I am of the opinion that a slight change in the present molding method will banish the trouble. I advised him to ram the sand firmly in the drag, particularly in the upper strata which comes under the cope. Riddle a layer of facing sand not over ½-inch in thickness over the pattern and surrounding joint. Dip the gaggers sparingly in thin claywash or paste and set them 3 or 4 inches apart. Ram the sand firmly in the cope and avoid hitting the gaggers. They will sink a little during the ramming process and will not be more than ¼-inch from the finished face. After the cope has been removed the sand in the drag is dug up and rerammed to the proper density."

Steel Founders Meet

(*Concluded from Page* 131)

data could be given to support this belief and particularly results based upon tests of the finished piece rather than a test specimen. David Evans, Chicago Steel Foundry Co., Chicago, cited forging imperfections which carried through from the steel ingot to the finished machine part. A foundryman making railway specialties reported supplying 16,000 forged hooks instead of cast steel hooks normally supplied with a certain car order. A test over a one-year period showed seven and one-half times the number of failures of the forged hooks as those encountered in the cast hooks.

W. H. Worrilow, Lebanon Steel Foundry, Lebanon, Pa., president of the society, opened the meeting and introduced W. W. Powell, Mesta Machine Co., Pittsburgh, chairman of the Central-Atlantic division, who presided at the combined session, Thursday. Reports of members covering orders, deliveries and operating rates, given at the morning meeting showed more than half the companies operating below 50 per cent, but 81 per cent report inquiries steady or increasing.

Granville P. Rogers, managing director of the society, in his report, told of the establishment of an engineering and metallurgical division under the direction of J. J. Baum, whose duties at present center largely on developing new uses of steel castings. The new division will embrace members from the engineering and metallurgical departments of companies that belong to the society.

Mr. Rogers noted several new activities which are being promoted by the society. Data are being collected for a survey, covering the distribution of steel casting sales by industries and by geographical divisions. A survey has been completed on the comparative rates of electrode consumption in electric melting. A committee is working on a handbook on steel castings. J. J. Baum, newly appointed engineer and metallurgist for the society, gave a paper on new uses of steel castings.

Meetings of the large casting and small casting divisions were held in the afternoon under chairmanship of T. H. Harvey, Ohio Steel Foundry Co., Lima, O., and Clarence Tolan Jr., Dodge Steel Co., Philadelphia, respectively.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

L. C. WILSON, formerly assistant plant manager, American Chain Co. Inc., York division, York, Pa., has been appointed plant manager, Reading Steel Casting Co., Reading, Pa., to succeed the late Ray J. Doty. Prior to his appointment with the American Chain Co., Mr. Wilson served as vice president, Federal Malleable Co., Milwaukee and as assistant to the president of the Interstate Iron & Steel Co., Chicago. He was graduated from Sheffield Scientific school, Yale university in 1907. Following a number of years with the Harbison-Walker Refractories Co., Pittsburgh, in the sales department, Mr. Wilson joined the staff of the Chain Belt Co., Milwaukee, as assistant to the vice president and later became general sales manager. He became associated with the Federal Malleable Co. as secretary and later was elected vice president and general manager. Mr. Wilson served from 1926 to 1929 as a director of the American Foundrymen's association and now is prominent in the work of various committees dealing with problems of the malleable iron branch of the industry.

T. A. Russell, acting president of Massey Harris Co. Ltd., Toronto, Ont., since November, has been elected president.

John D. Tyson, formerly assistant metallurgical engineer, Standard Steel Works Co., Burnham, Pa., has been appointed chief metallurgist.

Glenn Merrefield has resigned as foundry superintendent of Clark Equipment Co., Buchanan, Mich., to become identified in a similar capacity with Pettibone-Mulliken Co., Chicago.

Roy J. Giddings, formerly vice president and sales manager of Badger Wire & Iron Works, Milwaukee, now is identified with the newly-organized Wisconsin Art Bronze & Iron Co., Milwaukee, in similar capacities.

John J. Walsch, formerly superintendent of the electric steel foundry of Crucible Steel Casting Co., Lansdowne, Pa., has become affiliated with Clark Equipment Co., Buchanan, Mich., as works manager.

Keith Williams, vice president and general manager, Pratt & Letchworth Co., Buffalo, was elected to the board of directors of the Steel Founders' Society of America. He will fill the vacancy caused by the death of R. J. Doty, Reading Steel Casting Co., Reading, Pa.

C. O. Thieme, research metallurgist, H. Kramer & Co., Chicago, will address the regular monthly meeting of the Quad-City Foundrymen's association to be held April 20 at the Davenport chamber of commerce, Davenport, Iowa. Mr. Thieme will talk on "Brass Castings."

Hyman Bornstein, metallurgist, Deere & Co., Moline, Ill., addressed the St. Louis District Foundrymen's club, March 26, at a meeting held in the American Annex hotel, St. Louis. Mr. Bornstein spoke on "High Test Cast Iron" and illustrated his talk with slides. A lively discussion followed the address.

Charles E. Mitchell, associate manager, Gray Iron institute, Cleveland, addressed the Milwaukee branch of the institute recently on foundry costs. Mr. Mitchell also spoke of business conditions in the gray iron foundry industry and said that while the foundry had been the first to feel the depression, it was the first to begin recovery.

B. W. Burtsell has been appointed general manager, Massey Harris Co. Ltd., Toronto, Ont., and is to become a director and vice president. Mr. Burtsell served his apprenticeship with Brown & Sharpe Mfg. Co., Providence, R. I., and later became superintendent of Packard Motor Car Co., Detroit. He was president and general manager of the McKinnon Columbus Chain Ltd., St. Catharines, Ont., prior to its absorption by General Motors Corp.

C. S. Zipf, formerly manager, Bay City, Mich, plant, Ohio Steel Foundry Co., Lima, O., has been transferred to the Lima plant of the company following the closing temporarily of the former plant. Mr. Zipf has had a wide experience in steel founding. For six years, he was foreman at the Duquesne Steel Foundry Co., Coraopolis, Pa., and one year held a similar position with the Ohio Steel Foundry Co. He held the position of foundry superintendent for seven years and then was appointed works manager of the Bay City plant.

Edward C. Bullard, vice president and director, Bullard Co., Bridgeport, Conn., has been appointed general manager to succeed his uncle, the late Stanley Hale Bullard. A native of Bridgeport, he graduated from Sheffield Scientific school of Yale university in 1917 and was made assistant to his father, Dudley B. Bullard, chief engineer, in 1926. Three years later he was appointed an engineer in charge of design and research and in 1930 was elected a director. He is the eldest grandson of Edward Payson Bullard, founder of the company.

A. B. Wray, formerly sales manager, Morse Chain Co., Ithaca, N. Y., subsidiary of the Borg-Warner Corp., Chicago, has been appointed chief engineer in charge of all industrial chain engineering. **Walter W. Bertram,** formerly manager of the New York office of the company, has been appointed sales manager, industrial chain division. Mr. Bertram has been connected with the Morse company for 18 years. **R. W. Appleton** has been appointed purchasing agent at the Ithaca plant. Mr. Appleton formerly was director of purchases for the Pierce Arrow Motor Car Co.

J. J. Baum, formerly connected with the Ohio Steel Foundry Co., Springfield, O., has been appointed head of the development engineering department, Steel Founders' Society of America, New York. Mr. Baum attended Carnegie Institute of Technology, Pittsburgh, where he specialized in metallurgical engineering. During the 4½ years that he attended that institution, he devoted considerable time to metallurgical research work at local steel mills and foundries including the American Steel Foundries, Verona, Pa. Later he became chemist and metallurgist, National Alloy Steel Co., Blawnox, Pa., manufacturers of heat and corrosion resisting alloy castings. He resigned that position to become sales and design engineer, General Alloys Co., Boston. Later Mr. Baum became associated with the Ohio Steel Foundry Co., Springfield, O.

Our Thanks

IN PRESENTING the symposium of expressions on the importance of castings in various fields of industrial endeavor, THE FOUNDRY *is indebted to a large number of individuals and groups. To the leaders of the various industries represented,* THE FOUNDRY *wishes to express appreciation for the splendid cooperation given. Credit also is given to Blank and Stoller, New York, for supplying a number of the portraits, and to Armour & Co., Chicago, The Ohio Farmer, The Cleveland Plain Dealer, The Cleveland Press, Steel, and the Cleveland Terminal company for decorative photographs used.*

What the Foundries Are Doing

Reflecting the Activities of Gray Iron, Malleable, Steel and Brass Shops

New Haven Foundry, New Haven, Mich., is increasing operations.

The plant of the St. Joseph Electric Steel Casting Co., St. Joseph, Mich., recently was slightly damaged by fire.

Nashua Brass Co., Nashua, N. H., has experienced an increase in business since the first of the year.

Reynolds Mfg. Co., Springfield, Mo., plans to install equipment for the manufacture of aluminum castings. F. A. Meyer is secretary of the company.

Fremont Foundry Co., Dickinson street, Fremont, O., is building a new core room, 50 x 150 feet. Steinle & Wolfe are the architects.

Chris Erhart Foundry & Machine Co., Cincinnati, has been incorporated by Charles C. Erhart, Thomas H. Erhart and Mary G. Maloney.

Astoria Machine Co., New York, has been incorporated with $5000 capital by J. A. Boccia, 132 Nassau street, to operate as brass and iron founders.

Preliminary work on the construction of the new foundry being erected by the Sibley Machine Co., South Bend, Ind., has been started. (Noted April 1.)

White Mountain Freezer Co., Nashua, N. H., is operating on a full time schedule. That company reports business good.

Olympic Foundry Co., 5200 Ninth avenue south, Seattle, Wash., has completed plans for the erection of a shop building, 28 x 68 feet.

Carnegie Foundry & Machine Co., Carnegie, Pa., has been incorporated with $10,000 capital by E. L. McWilliams, 95 Bradford avenue, Crafton, Pa.

East Bay Pattern Works, 1044 Fifty-first avenue, Oakland, Calif., has been organized by J. Raymond and J. Gaidos. The company will manufacture metal patterns and aluminum castings.

Acme Pattern Co., Flint, Mich., has been incorporated with $17,500 capital by Harold E. Dennee and George A. Parker to design and manufacture wood and metal patterns.

Hillsen & Sandstrom Brass Foundry, 80 Ellsworth street, Worcester, Mass., has increased its force. The company has enjoyed increased business during the month of March.

Lindenwald Brass Foundry Co., 1006 Symmes avenue, Hamilton, O., recently was organized by Philip Falconi and Dan Falconi for the production of brass, bronze and aluminum castings.

S. & R. Grinding & Machine Co., Pittsburgh, has been incorporated with $10,000 capital by Gertrude Reynolds, 420 South Graham street, Pittsburgh, to manufacture and sell machinery, castings, forgings and bearings.

Kalamazoo Foundry & Machine Co., East Michigan avenue, Kalamazoo, Mich., is building a plant addition, 36 x 144 feet. Equipment has been secured. F. J. Buckley is president of the company.

Busch-Sulzer Bros. Diesel Engine Co., Second and Utah streets, St. Louis, will build a new erecting shop suitable for testing diesel engines rated as high as 25,000 horsepower per engine and an extension to the iron foundry which will contain a 75-ton crane runway. Edward P. Pollister is president and general manager.

Wm. Glatting Aluminum & Brass Foundry, 415 Bank avenue, Hamilton, O., recently started operations. The company will manufacture brass, bronze and aluminum castings. William Glatting is proprietor.

Tuna Iron Works, operated by the F. Hamilton Co., Bradford, Pa., is opening a plant in Elkland, Pa., in the building formerly occupied by the Elkland Foundry & Machine Shop. The company manufactures tools, boilers and engines.

Smith Steel Casting Co., Anderson, Ind., has begun operations in the plant of the Lavelle Foundry Co., Jefferson street and Central Indiana railroad. Sufficient orders are on hand to keep the plant running for several months, it is reported. (Noted March 1.)

Jackson Furnace & Foundry Co., Jackson, Mich., has changed its name to Jackson Foundry Co. The company produces gray iron, semisteel, aluminum and brass castings. J. G. Tawse is president, E. B. Nye vice president, and Anna N. Dugot secretary and treasurer.

Port Arthur Foundry Inc., Port Arthur, Tex., is completing the first unit of a gray iron foundry, 30 x 50 feet, which includes a 42-inch cupola. An overhead crane also will be installed. G. R. Brent is president and general manager, C. H. Steele, vice president and secretary and M. S. Steele, treasurer.

Bucyrus-Monighan Co. is the name of the new company formed by the purchase of the Monighan Foundry Co., Chicago, by the Bucyrus-Erie Co., Milwaukee. William W. Coleman, president and chairman of the Bucyrus-Erie Co.; E. K. Swigart, senior vice president; W. M. Bager, vice president; and George A. Morison, treasurer, Bucyrus-Erie Co., have been elected directors of the Bucyrus-Monighan Co. Retiring directors with the exception of C. B. Goodspeed, Harry Kleist, Rufus R. Rand Jr., and H. W. Voss, were re-elected.

Inland Iron Works Co, Okmulgee, Okla., has purchased the Okmulgee plant of the United Iron Works Inc., and will continue to operate it with the same personnel. The plant consists of gray iron, aluminum, brass and bronze foundries; a machine shop; plate and tank shop; structural shop; welding shop; and pattern and woodworking shops. The company will specialize in equipment and supplies for the oil and gas industries; utilities; lead and zinc smelters; glass plants; brick plants; coal mines; cement plants and miscellaneous products of iron and steel. L. T. LeBow is president. (Noted April 1.)

New Trade Publications

PYROMETERS—A recent folder from Illinois Testing Laboratories, Inc., 141 West Austin avenue, Chicago, emphasizes the importance of proper temperature in the heat treatment of steels and suggests the use of the indicating pyrometers made by the company. Several models are illustrated and described.

CLEANING EQUIPMENT—A current folder from the W. W. Sly Mfg. Co., Train avenue, Cleveland, illustrates sandblast equipment, tumbling mills and dust arresters. The service offered by the company is outlined, and a brief description of the apparatus used in typical installations is given.

REFRIGERATION CODE—American Standards association, New York, has published recently the American standard safety code for mechanical refrigeration as sponsored by the American Society of Refrigerating Engineers. The pamphlet includes a nomenclature of terms in refrigeration and a safety code to be followed in the installation and care of such equipment.

CARBON DIOXIDE INDICATOR—A catalog recently issued by the Brown Instrument Co., Philadelphia, illustrates and describes indicating and recording instruments for measuring the CO_2 content of flue gases. The importance of the CO_2 content in the flue gases is pointed out as a measure of combustion efficiency. Explanation of the operating principles of the instrument described is combined with illustrations of typical uses.

CHARGING CARS—Steel mill and foundry cars designed for charging and carrying ingots, and core oven cars and core racks are described in an illustrated bulletin, catalog No. 24, from the International Clay Machinery Co., Dayton, O. The equipment is shown in typical uses and design details are given in drawings. A sand conditioning machine, pug mills, grinding pans, roller bearings, annealing cars, and various miscellaneous cars also are illustrated and described.

ALUMINUM — National Smelting Co., Cleveland, has issued a folder giving details of the melting and pouring practice in the manufacture of aluminum alloy castings. The folder gives the pouring temperature for No. 12 and similar alloys and for silicon-aluminum alloys. It also discusses the method of adding gates and sprues to the charge and gives information on skimming and pouring. Further details are given on the correct furnace practice for crucible, iron pot, rotary and reverberatory furnaces.